

Hitler's 500-Acre Headache

POPULAR MECHANICS

MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

NOVEMBER
25 CENTS
30¢ IN CANADA



SEE PAGE 27

Completely at Sea

ABOUT WHAT BATTERY TO BUY?



BUY THE BATTERY THAT IS THE CHOICE OF EXPERTS

Why not let the experts help chart your course when you buy your next battery?

A million-mile, trans-ocean flying record has just been established by a Pan American Clipper equipped with Auto-Lite batteries. Auto-Lite batteries, too, are specified for service with our fighting

forces in tanks, half-tracs, jeeps . . . wherever dependable power counts most.

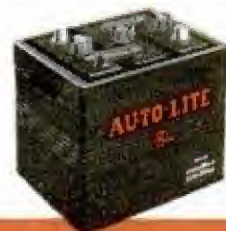
Make sure you get the longer life . . . the extra power you need today. Make your next battery an Auto-Lite—specified as original equipment by leading automotive engineers.

TOLEDO, 1 **AUTO-LITE BATTERY CORPORATION OHIO**
 Manufacturing Plants at: Niagara Falls, Indianapolis, Atlanta, Oakland, Oklahoma City, Toronto
BACK THE ATTACK WITH WAR BONDS



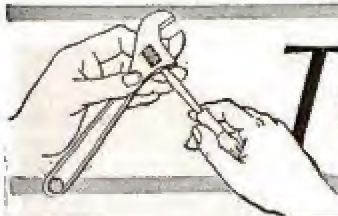
The "Million-Mile" Pan-American Clipper uses AUTO-LITE Batteries for its ocean-spanning record-breaking flights.

AUTO-LITE Batteries have been proved under fire on every fighting front.



AUTO-LITE
 means
AUTO-LIFE

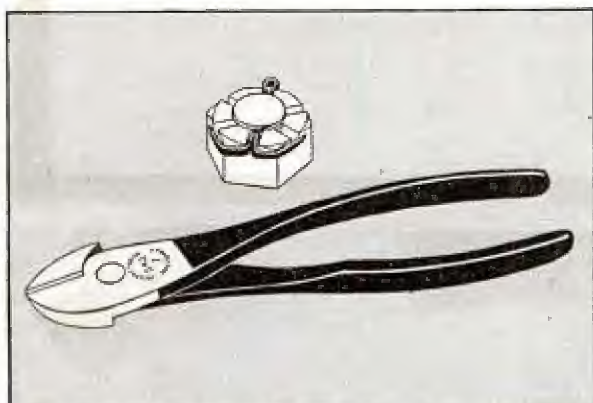
AUTO-LITE BATTERIES



TOOL NOTES

"How To Do It"
Information For
Crescent Tool Users

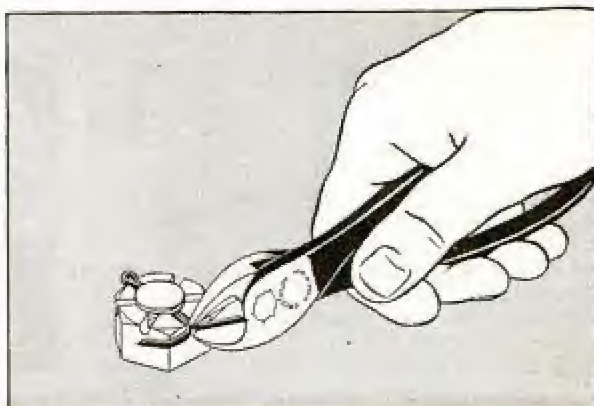
No. 13 HOW TO REMOVE COTTER KEYS



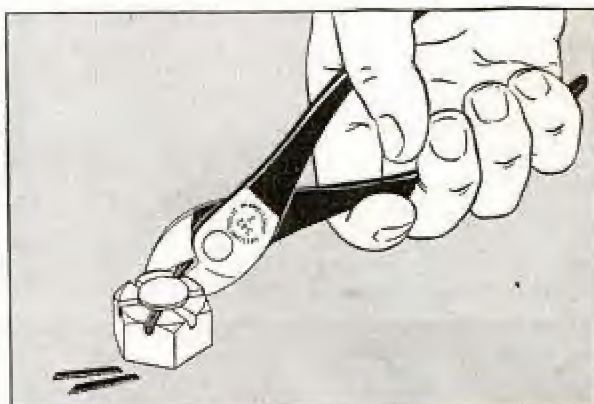
The following is a simple, effective and workmanlike method of removing cotter keys. It is not safe practice to reuse these keys and this method makes it impossible. Crescent's Heavy Diagonal Pliers, No. 542, should be used for this purpose.



First, straighten out the spread ends sufficiently to permit cutters to "bite" both pieces at one time as shown in following illustration.



With cutters close to nut, as shown above, sever spread ends with a single cut.



Now grip the head or "eyed" end of the cotter key as shown above and with a sideways motion, pry the cotter key out. *Don't attempt to pry it out without first cutting off the spread ends.*

MAIL THE COUPON . . . for Free Reprints of this series of informative ads. Please indicate whether you want them for bulletin board use, or punched for 3-ring binder.

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

CRESCENT TOOLS
Give Wings to Work

.....
Crescent Tool Co., Jamestown, N. Y. C-6

Please send your "Tool Notes" Series
☐ for Bulletins ☐ for 3-ring binder

Name _____

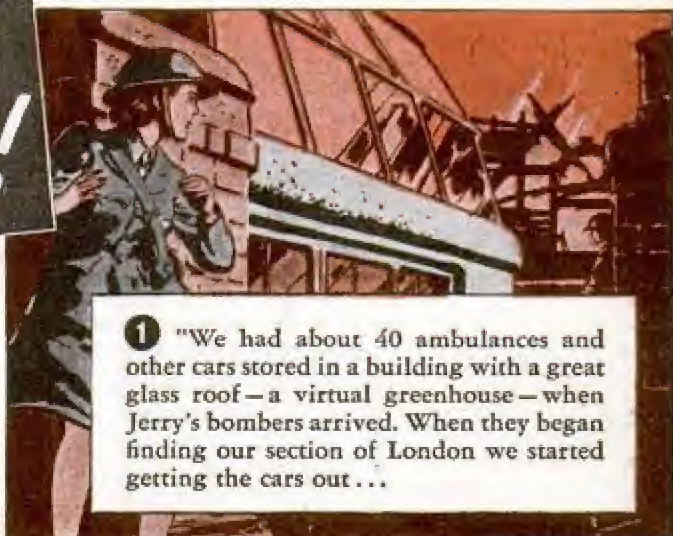
Address _____

City _____ State _____

BLITZED IN A GREENHOUSE!



(The exciting experience of Margaret Bridges, of the London Auxiliary Ambulance service, during one of London's heaviest raids. Pretty, attractive 30-year-old Miss Bridges is part English, part American. She volunteered for the ambulance service, reporting for duty just three days before war was declared.)

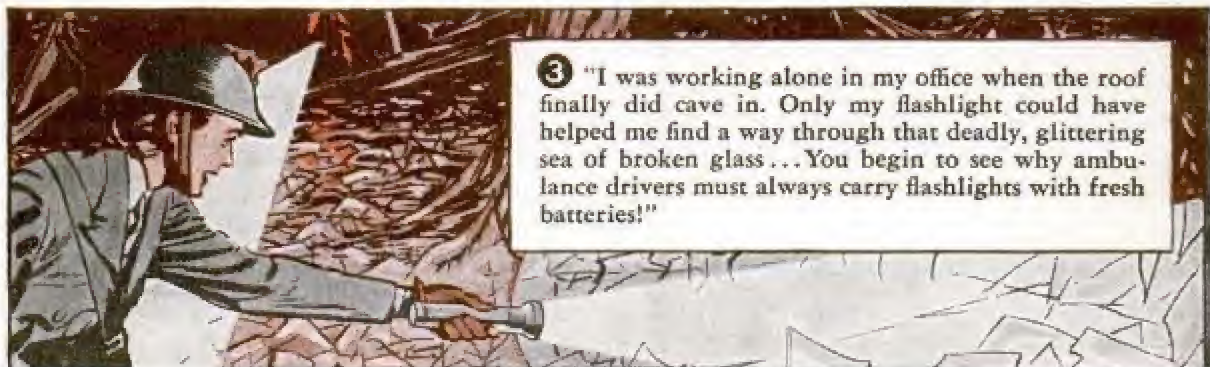


1 "We had about 40 ambulances and other cars stored in a building with a great glass roof—a virtual greenhouse—when Jerry's bombers arrived. When they began finding our section of London we started getting the cars out...

2 "Naturally, the transparent roof taboo'd ordinary lights. Yet we hadn't a moment to lose; with every sickening crash we expected the roof to splinter into a million heavy daggers. I got out my flashlight. In about ten minutes I had guided all the cars to safety...



3 "I was working alone in my office when the roof finally did cave in. Only my flashlight could have helped me find a way through that deadly, glittering sea of broken glass... You begin to see why ambulance drivers must always carry flashlights with fresh batteries!"



Your dealer may have no "Eveready" flashlight batteries. If so, please don't blame him—almost the entire supply is currently going to the armed forces and those war industries with the highest priority ratings.

Send for "You and the War," official O.C.D. guidebook to all vitally important war posts available to civilians. This free booklet tells exactly what there is to do and how to do it. Write National Carbon Company, Dept. DR, 30 E. 42nd St., New York 17, N. Y.

NATIONAL CARBON COMPANY, INC.
30 East 42nd Street, New York
Unit of Union Carbide and Carbon Corporation

NCC

The word "Eveready" is a registered trademark of National Carbon Company, Inc.

FRESH BATTERIES LAST LONGER...
Look for the DATE-LINE



Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

November, 1943

Vol. 80, No. 5

Next Month

SPIES have landed on American shores. They were very promptly snared in the FBI's efficient spy trap before they could perpetrate any sabotage. There have been derailments on the railroads, explosions in powder plants, sabotage in warplane factories—but not one incident has been traced to a paid enemy agent. As J. Edgar Hoover, director of the FBI, tells one of our staff writers in an article in the December issue, the war is going into the seventh inning and thus far the FBI has scored a shutout. Since the days of gangsters and kidnapers, hunting spies and draft dodgers has been a 24-hour job for G-men.

Task Force

WHEN the Navy has a job to do, a task force does it. There may never be two task forces alike; each is tailored of just the right component of destroyers and small craft, cruisers, aircraft carriers and perhaps battleships to accomplish the mission of the moment, which may be something as critical as the Battle of Midway. Next month, "Task Force—the Pick of the Fleet," tells how the flotilla is selected for its job.

Giant of the North

TWO-YEAR-OLD secret, the Shipshaw hydroelectric power plant in the wilds of northern Quebec will soon be ready to take off its wraps and go to work. A December feature tells how construction gangs battled 50-below-zero weather to dam the waters of the Saguenay, building a 1,500,000 horsepower plant to power nearby giant aluminum factories.

IN THIS ISSUE

Hitler's 500-Acre Headache	1
Airline to Anywhere	8
Cheating Death at Sea	18
Saga of the Redwoods	28
Engineering for War and Peace	34
Industry's Dr. Jekyll and Mr. Hyde	41
Behind the Scenes at a Launching	50
The Forty-Niners of '43	55
Wild Horses of the Sky	61
Kid Stuff for Grownups	66
White Magic	72
Casey Jones in Khaki	82

Where-to-Buy-It Index Starts on Next Page

Umbrella Army

BACK from Africa, three young veterans of the Yankee paratroops held a reunion at Camp Mackall, N. C., and traded stories while a member of our staff listened in. One had made the lowest parachute jump in history. Another, badly wounded, had survived a 20-millimeter shell that burst inside a transport plane, killing six men. The third had walked away unhurt after a 500-pound bomb hit the dirt 25 feet from where he lay, then had a jeep shot from under him the same day. For a stirring story of the paratroopers in action, read "Umbrella Army" next month.

Putting the Fight in Fighter Pilots

WHEN that budding fighter pilot levels off and streaks head-on for his instructor's plane, to pass it at a relative speed of 800 miles an hour, that's the beginning of as deadly a duel as any he'll fight—except that camera guns substitute for bullets. If he graduates from this school at 20,000 feet, he will go on to more hours of dog-fighting and formation flying at treetop and stratosphere altitudes in a "finishing school" for fighter pilots, described in a December article.

Published monthly by POPULAR MECHANICS COMPANY, 200 East Ontario Street, Chicago (11), Ill., U. S. A. Single copy in the United States, 25 cents; subscription rates in United States and possessions, and countries of the Pan-American Postal Union, \$2.50 a year. Single copy in Canada, 30 cents; subscription rates, \$3.00 a year. To all other countries add \$1.00 a year over United States prices for overseas postage. If you plan to move, notify us at least 60 days in advance so you will not miss an issue. Give both old and new addresses. Entered as Second Class Matter, September 15, 1903, at the Post Office at Chicago, Illinois, under Act of March 3, 1879. Entered as Second Class Matter at Post Office Dept., Canada.
Copyright 1943, by Popular Mechanics Company, Copyright under International Copyright Union. All rights reserved under Pan American Copyright Union. Printed in the United States of America

CLEAN OUT THAT ENGINE NOW!



THE TOUGHEST MILES ARE YET TO COME!

It's easy to put off the job of getting your car ready for colder weather. But, Mister, if you neglect your car too long, it may neglect you!

Miles will get tougher now. Against this, your car can stand a good check up, end to end. Start in by giving the engine a good clean out with Pyroil. Ten to one this will eliminate troubles before they hatch.

A pint of Pyroil in the crankcase, a few ounces in the gasoline tank, are all you need. Tough miles then become miles of smoothness. Because Pyroil goes right to work, safely eliminating the summer's incrustations of sludge, gum, "varnish," rust, and the elements that create dangerous corrosive attack on metal parts.

Keep your car fit until Victory. Pyroil will help you do it. Ask your service station man about this, today. Manufactured and Guaranteed by Pyroil Company, W. V. Kisdor, Founder, 511 Pyroil Bldg., LaCrosse, Wisconsin, U. S. A.

Victory Size Pyroil—3 Ounces For the Gasoline Tank

IF WAR-TIME CONDITIONS HAVE AFFECTED YOUR FAVORITE LOCAL SUPPLIER OF PYROIL—MAIL COUPON BELOW.

WIDELY USED IN THE INDUSTRIAL FIELD AND ON THE FARM.

12 YEARS' ACCEPTANCE BY FOREMOST AUTHORITIES—RACE DRIVERS—EXPLORERS—ENGINEERS—YOUR GUARANTEE



Buy Another War Bond Today

DISTRIBUTORS: CHECK AND MAIL COUPON FOR FRANCHISE FACTS.

PYROIL COMPANY
511 Pyroil Bldg., LaCrosse, Wisconsin

Please send me the names and addresses of war-time suppliers of Pyroil, locally.

☐ Send details of your Plan for Distributors

Name

Address

City or Town.....State.....

WHERE-TO-BUY-IT INDEX

Where no name and address appear directly under an item, the product is not believed by us to be commercially available.

"Dry firing" target range.....	6
Ship gunners wear asbestos suits.....	7
Arctic tractor has buggy top.....	7
Future homes to have lavish lighting.....	7
Mobile hoist loads planes.....	12
Elwell-Parker Elec. Co., Cleveland, Ohio.....	12
Glider in flight roars "Shhh".....	12
Sound waves detect tire breaks.....	12
Drug penicillin aids wounded.....	13
Supergas raises engine power.....	13
Why an airplane flies.....	14
Wheel hoists lift plane from factory cradle.....	16
Gauge measures all pipe sizes.....	16
Three-Point Gage Co., 3821 Broadway, Chicago.....	17
Spotters wheel aids plane identification.....	17
Trailer locates site for transmitter.....	17
"Breathing" wall keeps out moisture.....	26
Collapsible plane-wheel chock.....	26
"Tank tread" landing gear for planes.....	27
Largest mobile gun in world.....	27
Training machine gun fires plastic pellets.....	33
Dry-land diving.....	33
Flying air car has hook-on wings.....	38
"Submarine" camera films divers.....	39
Plane de-icer heated by exhaust.....	39
Giant fan exhausts hot gas.....	40
"Remote" compass in plane wing.....	40
Portable darkroom.....	40
Candle-lit dish heater.....	45
Robert Keith, 13th and Baltimore, Kansas City, Mo.....	45
Magnet removes object from stomach.....	45
War maps while you wait.....	46
Capless pen has retracting nib.....	48
Andrews Pen Co., 1435 W. 25th St., Los Angeles, Calif.....	48
Jamming of epiglottis may cause bomb death.....	48
Punch slides in metal sleeve.....	48
Tru-Punch, Scotch Plains, N. J.....	49
Giant firing range.....	49
Venetian blind aids blind-flying training.....	59
Soldiers ride seasickness machine.....	59
500,000-pound motor.....	60
Resin in concrete keeps it from scaling.....	60
Armored jackets protect fliers from flak.....	60
Saw fits on electric drill.....	65
Mid-States Equip. Co., 2429 S. Michigan, Chicago.....	65
Hand-operated metal crimper.....	65
C-B Tools, Lancaster, Pa.....	71
"Enemy" on film teaches Navy gunners.....	71
Tool punches flanged holes.....	71
C-B Tools, Lancaster, Pa.....	76
Inspectors ride bikes inside big dam.....	76
Stop nut for plywood planes.....	76
Electric eye stops blind worker's machine.....	76
Hot metal sprayed like paint.....	76
Alloy-Sprayer Co., 2040 Book Tower Bldg., Detroit, Mich.....	77
Yanks train with live ammunition.....	77
Mine killers at work.....	78
Goggles fit over spectacles.....	80
Frederick-Clinton Co., 545 Fifth Ave., New York.....	80
Dry stickers hold blueprints.....	80
Avery Adhesives, 451 E. 3rd St., Los Angeles, Calif.....	80
Chemical reactives antifreeze.....	80
Iron box for war-plant matches.....	80
Jeeps and pick-a-back seats carry wounded.....	81
Shortening hairpins saves tons of steel.....	81
Stoves made of baked clay.....	87
"Spot-a-Graph" times sound effects.....	87
Heroservice, 45 W. 45th St., New York City.....	87
Disk thermometer cements to window.....	87
Precision Products Co., Waltham, Mass.....	88
Inch-thick kit for aviators.....	88
Postwar uses of nylon.....	88
"Ducking bridge" lowers for ships to pass.....	88
Shock-proof screwdriver for radio workers.....	144
Vaco Products Company, 1123 W. Washington Blvd., Chicago.....	144
Screwdriver has aligning tool in plastic handle.....	144
Vaco Products Company, 1123 W. Washington Blvd., Chicago.....	144

Craftsman and Shop Notes Index

ART AND ARTIST	
Drawing parallel lines.....	98
Handy thumbtack holder.....	129
AUTOMOTIVE	
Eraser used as valve-stem cap.....	92
Warning light shows when brake is on.....	96
Soap aids in replacing windshield.....	99
Disconnect battery while cleaning motor.....	104
Rheostat controls generator output.....	114
More miles from gas coupons.....	115
Installing heater hose easily.....	118
Radius-rod bushing installed with air hose.....	130
Increasing ignition efficiency.....	130
CAMPING, HUNTING AND FISHING	
Tool cuts gun-cleaning patches.....	91
Preserving fishing tackle.....	99
FARM	
Invisible braces for gate post.....	98
Preventing thread cuttings from entering pump cylinder.....	104
Successful cleft-grafting of trees.....	118
Mixing feed accurately.....	140
HAND TOOLS	
Making C-clamps more useful.....	92
Punch to perforate paper.....	92

(Continued to page 6A)

Can a man have "Oomph"?

— SURE

Pipe Appeal



PIPE APPEAL—Prince Albert!
Pleasing fragrance to keep her smiling. No-bite mildness to keep you smiling. Rich taste, yet so easy on your tongue. Crimp cut to pour, pack, and draw *smoothly*, and help a pipe to cake up better. Better tobacco—world's largest-selling brand. Prince Albert for **PIPE APPEAL**!

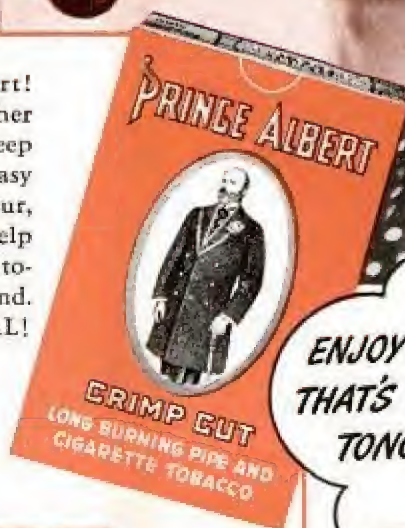
PRINCE
*
ALBERT

BUY
WAR
BONDS
AND
STAMPS

R. J. Reynolds Tobacco Company, Winston-Salem, N. C.

50 pipefuls of fragrant tobacco in every handy pocket package of Prince Albert

70 fine roll-your-own cigarettes in every handy pocket package of Prince Albert



ENJOY **RICH TASTE**
THAT'S EASY ON YOUR
TONGUE—

**GET
P.A.**



This One



68J5-ZZN-S3CA

NOVEMBER, 1943

5A

"FUSSY" CRAFTSMAN? These are the tools for you!

FOR CRAFTSMEN who want to know their work is accurate, Millers Falls makes an interesting line of precision tools including 14 sizes and styles of steel rules and slide calipers — light, semi-flexible, flexible, and narrow. They're all of carefully heat-treated crucible steel, ground and polished, and graduated with precision by dividing engines developed and perfected by our own engineers over a period of forty-odd years. Accuracy guaranteed.



THOUGH moderately priced, Millers Falls surface gauges are well-made, well-finished, and unusually versatile. Base is ground for use on flat surface plate and grooved for cylinder. Scriber is spring-held in position as thumb nut is tightened... a big help for quick, accurate settings. Spindle can be used as depth or scratch gauge. Many other features for accuracy and convenience demonstrate this tool's background of long skill and experience.



LONG
AMONG the
most highly-
prized items of
Goodell-Pratt
(now part of

Millers Falls Company, whose name now appears on most former Goodell-Pratt tools) has been this Combination Set — blade, beam, protractor, and center head — the most useful precision tool ever made for machinists and toolmakers. Accurate graduations, all working faces precision ground; tempered crucible steel blade; complete with level and scriber.

MILLERS FALLS TOOLS

SINCE
1868

MILLERS FALLS
COMPANY

Greenfield, Mass.
U.S.A.

(Continued from page 4A)

Preventing loss of folding rule.....	98
Handy oiler for tools.....	114
Screen wire used as magnet shield.....	118
Guide for hand punch.....	119
Depth stop for twist drills.....	128
Multiple marking gauge.....	130
Ferrules made from old spark plugs.....	133
Tape used as beam compass.....	139

HOME IMPROVEMENTS

Mirror used to inspect door bottom.....	102
Beveling makes neat building-trim patches.....	102
Upholster it yourself.....	106

HOUSEHOLD

Colorful holiday tray.....	91
Noninflammable grease remover.....	91
Novel curtain tiebacks.....	93
Solving home problems.....	94
Removing ball from drain.....	102
Novelty match boxes.....	102
Moving refrigerator easily.....	105
Cleaning oil-stove feed line.....	116
Hanger to dry rayon stockings.....	118
Cup caster prevents creeping of washer.....	118
"Bowknot" window cornice.....	119
Removing paper from varnished surface.....	119

MODELMAKING

Glass beads used as bearings.....	98
Bent pins serve as clamps.....	104
Bending thin wood strips.....	114

PHOTOGRAPHY

Animal photos.....	120
Portrait has movable eyes.....	123
Nail polish smooths edges of mask.....	123
Chemical scoop made from old film.....	123
Nonspill tray made of wood.....	124
Staples identify paper boxes.....	124
Making permanent titles on prints.....	124
Ferrottype plates made easy to pick up.....	124
Cellulose tape removes lint from print.....	124

POWER TOOLS

Locking sandpaper on drum.....	104
Dresser for grinding wheel.....	128
Countersink used for chamfering.....	128
Chip shield for lathe.....	128
Portable power unit.....	129
Making a taper-shank faceplate.....	131
Back rest to steady long work.....	132
Using a surface grinder.....	134
Universal drill-press vise.....	139

RADIO AND ELECTRICITY

Radio loud speakers of modern design.....	141
Six-volt blackout emergency receiver.....	142
Student-type ultra-high frequency antenna mast.....	144
Extra soldering tip for hard-to-reach chassis jobs.....	144
Repairing carbon-type volume controls.....	144
Paper-type by-pass condenser substitutes for voltmeter.....	144
Stopping speaker rattles in midget sets.....	144
Homemade dual-outlet line noise filter.....	144

STORE AND SHOP

Counting labels with micrometer.....	98
New faces for old clocks.....	114
Making pyramid fruit displays.....	128
Clamping type in gallery.....	128
Grease cup dispensers make ready paste.....	129
Stops hold carton flaps while packing.....	133
Points on truck raise heavy crates.....	140
String cutter from shade bracket.....	140

TOYS, GAMES AND NOVELTIES

Jack-o-lantern from paper bag.....	98
Coaster has built-in windshield.....	105

WOODWORKING

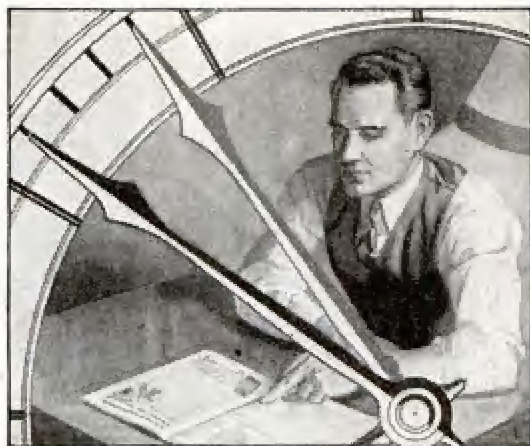
Inexpensive dowel markers.....	102
Squaring tapered columns.....	104
Food grinder used as clamp.....	104

MISCELLANEOUS

Pictures "embroidered" in wire.....	89
Folding checkerboards for servicemen.....	92
Care of bike chains.....	93
Badge worn without damaging lapel.....	96
Blotter attached to check book.....	96
Sharpening pencil for use on wood.....	96
Folding card table.....	97
Child's chest-bed.....	100
Installing heavy coil springs.....	102
Getting maximum flashlight-battery service.....	105
Preventing loss of oil-can caps.....	113
Binder for large sheets.....	113
Nail-polish brush used for painting.....	113
Removing adhesive left by tape.....	113
Wedge washer locks nut on bolt.....	114
Precision measuring with microscope.....	125
Button pockets for nail apron.....	130
Quick location of fire extinguisher.....	130
How to build up shafts.....	133
Making a bronze bushing.....	133
Handy marker for large catalogue.....	140
Clamp holds paper sheets for trimming.....	140

IMPORTANT NOTICE

It is the intention of this magazine to provide its readers with information regarding the latest developments in the mechanical arts. We take no responsibility as to whether the disclosures contained in our articles are covered by patents and advise readers to investigate this subject before making, using, or selling any of the products, machines, or processes described in order to avoid possible liability for patent infringement.



How Do You Use The Most Important Hours of Your Day?

The most important—and they can be the most profitable, too. Men—ordinary men in ordinary circumstances—have had returns of as high as \$5, \$10, \$25, even in exceptional cases \$50 per hour for these hours.

They are the hours of your leisure time—usually spent in recreation or odds and ends.

These can be your growth hours, the time when through training you can prepare for more efficient service on the job or for the job ahead. During your working hours, you are usually buried in routine details, growing slowly if at all. But in these spare hours, your mind can reach out to absorb the experience of others, to learn the principles and methods behind your job and behind your field. The next day on the job, you will find yourself using something of what you learned the night before to the benefit of your job and the pleasure of your boss.

Interestingly enough, this spare time study can be fascinating recreation, not drudgery. And the few minutes spent this way tone up the remaining hours of your leisure

—make them more interesting.

WHAT CAN THEY MEAN TO YOU?

We can't say exactly. But we can tell you what they have meant to thousands of others. They have brought to these men and women promotions, new jobs, more money and prestige, greater success and happiness, security for the future. If these are the things you want, we invite your investigation of LaSalle home study training.

For, from our 34 years' training, over a million men and women, we have learned what you need and how to give it to you. Our training is geared to the busy individual who is ambitious and earnest for better things. Check on

the coupon below the field in which you are interested. We'll send you—without obligation our free 48-page booklet, discussing the opportunities and requirements in that field and telling about our training for it. If not entirely sure which field to check, write us rather fully about your problem and let us counsel you.

LaSalle Extension University A Correspondence Institution

DEPT. 1164-R

CHICAGO, ILL.

I am interested in knowing how I can use my spare time to advance myself. Please send your free booklet on the field I have checked below.

- | | |
|--|--|
| <input type="checkbox"/> Modern Foremanship | <input type="checkbox"/> Industrial Management |
| <input type="checkbox"/> Accounting | <input type="checkbox"/> Expert Bookkeeping |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Law: LL.B. Degree |
| <input type="checkbox"/> Executive Management | <input type="checkbox"/> Business Law |
| <input type="checkbox"/> Salesmanship | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Business Correspondence | <input type="checkbox"/> Stenotypy |

Name

Age

Position

Address

IMAGINE THEIR JOY

WHEN THEY FOUND THEY COULD PLAY

This easy as A.B.C. way!



LEARN QUICKLY AT HOME

"I didn't dream I could actually learn to play without a teacher. Now, when I play for people they hardly believe that I learned to play so well in so short a time."

*H. C. S., Calif.



WOULDN'T TAKE \$1000 FOR COURSE

"The lessons are so simple that anyone can understand them. I have learned to play by note in a little more than a month. I wouldn't take a thousand dollars for my course."

*S. E. A., Kansas City, Mo.



PLAYS AT DANCES

"I have completed your course and your lessons have been most satisfactory. I can play all of the popular songs. I have also earned money playing at dances."

*E.N.J., New York.

PLAYS ON RADIO

"As a proud student I can't keep from telling you that as a result of my course I have a good position playing from KTHS, Hot Springs, Ark., every morning."

*J. S., Okla.



"YOU CAN'T BEAT IT!"

"I am glad to tell anyone about the U. S. School. It is just what they say it is and they will do what they say they will. If you want to learn music you can't beat it!"

*W. E. D., N. Mex.

Thousands Have Learned to Play for Less Than 7c a Day

WHAT instrument would you like to play? We'll show you how you can learn to play it—quickly, easily, in spare time at home for less than SEVEN CENTS A DAY! Never mind if you don't know one note of music from another—don't worry about "special talent."

The truth of the matter is that thousands now play who never thought they could! Yes, men and women everywhere are enjoying the thrilling satisfaction of playing the piano, violin, guitar, saxophone or other favorite instrument. Some of them are playing in orchestras and over the radio; others are teaching music, making money in spare or full time. And thousands are

playing for their own enjoyment and the entertainment of their friends.

It all came about when they wrote to the U. S. School of Music for the Free Booklet that shows you how EASY it is to learn music at home this modern way. No tedious scales, no tiresome exercises. You learn to play by playing—start right in almost at once with the melody of a simple tune! It takes only a few minutes a day and the cost is trifling; you save the expense of a private teacher. Does it sound too good to be true? Mail the coupon and get the FREE PROOF! (Our forty-fifth year—Est. 1898.) U. S. School of Music, 711 Brunswick Bldg., New York 10, N. Y.

NOTICE

Please do not confuse the U. S. School of Music method with any system of teaching music "by ear" or by trick charts. Our method teaches you to play by actual notes, . . . not by any "trick" or number system. You are able to pick up any piece of regular sheet music and play by note. And once you've learned to play by note it's just like learning your A-B-C's. It never leaves you—you remember it for life.

SEND FOR FREE → PRINT AND PICTURE SAMPLE

• You'll open your eyes when you find how quickly and easily you can learn to play your favorite instrument. Don't doubt; don't hesitate. Send for the fascinating illustrated booklet that answers all your questions; let the free Print and Picture Sample show you how this method actually works. If interested, mail the coupon NOW.

*Actual pupils' names on request.
Pictures by professional models.

SUCCESSFUL 45TH YEAR

U. S. SCHOOL OF MUSIC

711 Brunswick Bldg., New York 10, N. Y.

I am interested in music study, particularly in the instrument checked below. Please send me your free illustrated booklet, "How to Learn Music at Home."

Piano	Saxophone	Modern Elementary
Guitar	Trumpet, Cornet	Harmony
Hawaiian Guitar	Reed Organ	Practical Finger
Violin	Tenor Banjo	Control
Piano Accordion	Mandolin	Other Instrument

Have you instrument?.....

Name
(Please Print)

Address

City State

NOTE: If you are under 18 years parent must sign coupon.

Save 2c—Stick coupon on penny postcard.



DRAFTING

SPRINGBOARD TO SUCCESS!

MANY men today are using drafting boards to help win this war! • The International Correspondence Schools Courses in Mechanical or Architectural Drafting have fitted many hundreds of ambitious men for better jobs in this well-paid field! • All I. C. S. Courses (covering 400 business and technical subjects) are prepared by leading *practical* authorities, constantly revised to meet new developments. *Yet the cost of I. C. S. training is surprisingly low.* • It's not too late for you to start—help your country, help yourself! Mail this coupon *today!*



INTERNATIONAL CORRESPONDENCE SCHOOLS

HELPING TO TRAIN AMERICANS FOR VICTORY

BOX 5675-J, SCRANTON, PENNA.

Without cost or obligation, please send me booklet and full particulars about the course *before* which I have marked X:

SPECIAL
TUITION RATES
FOR MEMBERS
OF THE
ARMED FORCES



- ☐ Airplane Drafting
- ☐ Architectural Drafting
- ☐ Electrical Drafting
- ☐ Mechanical Drafting
- ☐ Ship Drafting
- ☐ Structural Drafting
- ☐ Blueprint Reading
- ☐ Air Brake
- ☐ Air Conditioning
- ☐ Architecture
- ☐ Auto Engine Tune-up
- ☐ Auto Technician
- ☐ Aviation ☐ Aviation Mechanic
- ☐ Boilermaking

- TECHNICAL AND INDUSTRIAL COURSES**
- ☐ Bridge Engineering
 - ☐ Chemistry ☐ Coal Mining
 - ☐ Civil Engineering
 - ☐ Concrete Engineering
 - ☐ Contracting and Building
 - ☐ Cotton Manufacturing
 - ☐ Diesel Engines
 - ☐ Electrical Engineering
 - ☐ Electrician
 - ☐ Electrical Maintenance
 - ☐ Foundryman ☐ Heating
 - ☐ Heat Treatment of Metals
 - ☐ Highway Engineering
 - ☐ House Planning
 - ☐ Industrial Metallurgy
 - ☐ Locomotive Engineer
 - ☐ Machinist ☐ Inspector
 - ☐ Management of Inventions
 - ☐ Marine Engines
 - ☐ Mechanical Engineering
 - ☐ Mine Foreman
 - ☐ Navigation ☐ Patternmaking
 - ☐ Plastics ☐ Plumbing
 - ☐ Public Works Engineering
 - ☐ Pulp and Paper Making
 - ☐ Radio, General
 - ☐ Radio Operating
 - ☐ Radio Servicing

- ☐ R. R. Section Foreman
- ☐ R. R. Signalman ☐ Refrigeration
- ☐ Sanitary Engineering
- ☐ Sheet Metal Work
- ☐ Shipfitting ☐ Shop Practice
- ☐ Steam Electric ☐ Steam Engines
- ☐ Steam Fitting
- ☐ Structural Engineering
- ☐ Surveying and Mapping
- ☐ Telegraphy ☐ Telephony
- ☐ Textile Designing
- ☐ Toolmaking ☐ Tool Design
- ☐ Welding, Gas and Electric
- ☐ Woolen Manufacturing

- ☐ Accounting ☐ Advertising
- ☐ Bookkeeping
- ☐ Business Correspondence
- ☐ Business Management
- ☐ Cartooning ☐ Civil Service

- BUSINESS COURSES**
- ☐ College Preparatory
 - ☐ Commercial
 - ☐ Commercial Illustrating
 - ☐ Cost Accounting
 - ☐ C. P. Accounting
 - ☐ First Year College
 - ☐ Foremanship ☐ French
 - ☐ Good English
 - ☐ High School
 - ☐ Managing Men at Work

- ☐ Railway Postal Clerk
- ☐ Salesmanship
- ☐ Secretarial ☐ Spanish
- ☐ Showcard and Sign Lettering
- ☐ Traffic Management

- ☐ Advanced Dressmaking
- ☐ Foods and Cookery

- HOME ECONOMICS COURSES**
- ☐ Home Dressmaking
 - ☐ Professional Dressmaking and Designing

- ☐ Tea Room and Cafeteria Management, Catering

Name.....Age.....Address.....

City.....State.....Present Position.....

Canadian residents send coupon to International Correspondence Schools Canadian, Limited, Montreal, Canada
British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England

WANTED

1000 High School Seniors

TO COME TO CALIFORNIA TO ENROLL IMMEDIATELY IN THE AERO TECH COMBINED AVIATION AND 4TH YEAR HIGH SCHOOL COURSE

Make the most of the next twelve months by finishing your fourth year of high school at Aero Tech where you can combine with it aircraft mechanics or engineering studies. Even though you may be back in high school, if you act now, you can still enroll in these courses.

GAIN A FULL YEAR OF AVIATION TRAINING

You will be doing far more for yourself and your country by combining your last year in high school with aircraft mechanics or engineering. Whether you go into military service or war industry at the end of your training, you will possess technical qualifications that will raise you above the average of others and open the door to specialized assignments.

APPROVED HIGH SCHOOL AND AVIATION COURSES

State Certified and CAA licensed instructors supervise your high school and aviation training. When successfully completed you receive your High School diploma in addition to your Certificate of Award covering your aviation course. If you combine the High School and the Master Mechanics Courses you would then be eligible to qualify for CAA Airplane and Engine license.

ONE AND TWO YEAR ENGINEERING

You can continue your technical studies by taking the Aero Tech one or two year Aeronautical Engineering Course. Advance training in post-graduate subjects and research is also available.

YOU CAN EASILY TRANSFER

Merely secure a transcript of your grades and full credit will be given you when you enroll at Aero Tech.

IDEAL LIVING IN CALIFORNIA

You will probably choose to live in Aero Tech's new dormitories, adjoining the campus. Under the supervision of the Students Welfare Council, you will enjoy comfortable lodgings, wholesome food and real companionship.



SEND COUPON TODAY for Enrollment Application

AERO INDUSTRIES TECHNICAL INSTITUTE

5225 W. San Fernando Road, Los Angeles 26, Calif.

Gentlemen: Please send details and enrollment application on course checked below, without obligation:

Master Mechanics with ☐ or without ☐ 4th year high school
Aeronautical Engineering with ☐ or without ☐ 4th year high school
Special Aircraft Pre-Induction with ☐ or without ☐ 4th year high school

NAME.....AGE.....

STREET.....

CITY.....STATE.....A-3-p

Be an ARTIST!

—Train at Home in Your Spare Time For an Interesting Hobby and Profitable Postwar Career!

The fascinating field of Art offers commercial opportunities to men and women. **COMMERCIAL ART, CARTOONING, DESIGNING** all in one complete course. **TWO ART OUTFITS** furnished. Learn to draw step-by-step. Write today for full information in **FREE BOOK**, "Art for Pleasure and Profit." No obligation. **STATE AGE.**

WASHINGTON SCHOOL of ART, Studio 1211-F 1115—15th St., N. W., WASHINGTON 5, D. C.

FREE BOOK gives details

LEARN WATCH REPAIRING



AT HOME. By our modern and original system of instruction you can learn every part of the **WATCH REPAIRING TRADE AT HOME.** Prepare yourself for a well-paying position or start in business after completing our course of instruction. Good watch repairers are in demand and generally earn very good salaries. For particulars apply to the **Wisconsin School of Watch Repairing 524 E. Mason St., MILWAUKEE 2, WIS.**



TRI-STATE COLLEGE

B. S. Degree in 27 Months

Distinguished for technical 2 1/2-year courses in Civil, Electrical, Mechanical, Chemical, Radio, Aeronautical Engineering; Business Administration, Accounting, and Secretarial Science.

MEN AND WOMEN—3 yr. high school students with good record admitted. Special Preparatory Department. Modern laboratories, latest equipment. Low tuition. Low living costs. Cosmopolitan student body. 60th year. Enter January, March, June, September. Write for catalog. **4113 College Ave. ANGOLA, INDIANA**

TRAIN Your VOICE!

Results GUARANTEED

We build, strengthen the vocal organs—not with singing lessons—but by sound, scientifically correct silent and vocal exercises and absolutely guarantee complete satisfaction with results. Write for Voice Book, FREE. Sent to no one under 17 years old unless signed by parent. **PERFECT VOICE INSTITUTE, Studio 1258, 64 E. Lake St., Chicago, Ill.**

REFRIGERATION

Repair and improve all refrigerators. New manual tells how. Charts and pictures to help you. Price only \$1.00, postpaid. Money back guarantee. Supreme Publications, 329 S. Jefferson St., Chicago 6, Illinois.

LAW

STUDY AT HOME for PERSONAL SUCCESS and LARGER EARNINGS. 31 years expert instruction—over 100,000 students enrolled. LL.B. Degree awarded. All texts furnished. Easy payments. Send for **FREE BOOK—**"Law and Executive Guidance."
AMERICAN EXTENSION SCHOOL OF LAW Dept. 35-M 8 East Huron St. Chicago, Ill.

SAVE RUBBER

Easy to fix cuts, bruises, worn spots in tires. So-Lo also mends shoes, raincoats, boots—anything of rubber, leather, cloth.

MEND the HOLE for 1¢

So-Lo SPREADS ON like butter. Dries tough overnight. Flexible. Non-skid. Waterproof. Won't come off—guaranteed.
AT HARDWARE & 10c STORES

AUDELS AIRCRAFT WORKER.....\$1

Answers Your Questions on 1—Aircraft Materials, Terms, Parts, 2—Blueprints, Working Drawings, 3—Mathematics, How to Figure, 4—Layout & Bending, 5—Tools & Machines, 6—Riveting, Spot Welding & Hints, 7—Fabrication, Angles, etc. 8—Assembly, Fuselage, Wing & Final—How to Use Tools, 9—Tables & Data, Symbols, Army & Navy Specifications, etc. 240 Pages illus.

AUDELS SHEETMETAL

PATTERN LAYOUTS.....\$4

Developed by Experts for Sheet Metal Workers, Layout Men & Mechanics. A Practical Encyclopedia in 10 Sections, size 7 x 10 x 2—1125 Pages—350 Layouts—1600 Illustrations, 1001 Key Facts. Fully indexed for ready reference in answering your layout problems. Covers all phases of sheet metal work including Pattern Cutting, Pattern Development & Shop Procedure.

AUDELS SHEETMETAL WORKERS

HANDY BOOK.....\$1

Practical Inside Information. Fundamentals of Sheet Metal Work. 388 pages, illustrated, 11 sections. Clearly written. Essential & important facts, figures, pointers in everyday language. Ref. Index.

AUDELS WELDERS GUIDE.....\$1

A concise, practical text on operation & maintenance of all welding machines for all mechanics. Over 400 pages, illustrated. Covers all methods of electric and acetylene welding including airplane work.

AUDELS ANSWERS ON

BLUE PRINT READING.....\$2

For Mechanics & Builders. Covers all types of blue print reading including ship & airplane, 376 pages, fully illustrated.

AUDELS NEW MACHINIST &

TOOLMAKERS HANDY BOOK...\$4

Covers modern machine shop practice in all its branches. 5 practical books in 1. New from cover to cover. Tells how to set up & operate lathes, screw and milling machines, shapers, drill presses and all other machine tools. 1600 pages, fully illustrated, 5 x 8 1/2 x 2. Indexed. 5 sections. 1—Modern Machine Shop Practice. 2—Blue Print Reading & How to Draw. 3—Calculations & Mathematics for Machinists. 4—Shop Physics. 5—How to Use the Slide Rule. 60 chapters. Easy to read and understand. A shop companion that answers your questions.

AUDELS MATHEMATICS &

CALCULATIONS FOR MECHANICS \$2

Mathematics for home study or reference. 700 pages, 550 illus. Practical mathematics from beginning. How to figure correctly. Easy, correct methods covering a complete review. Ill. & Indexed.

AUDELS AUTOMOBILE GUIDE.....\$4

A practical quick ready reference book for auto mechanics, service men, operators & owners. Explains theory, construction & servicing of modern motors cars, trucks, buses & auto type Diesel engines. 1640 pages, fully illustrated, 65 chapters. Indexed. A standard book for mechanics. New fluid drive covered.

AUDELS DIESEL ENGINE MANUAL \$2

A practical, concise treatise with questions and answers on the theory, operation and maintenance of modern diesel engines including General Motors 2 cycle Diesel. 384 pages, fully illus., flexible binding, pocket size. All details plainly brought out, this book is of extreme value to engineers, operators & students.

AUDELS RADIOMANS GUIDE.....\$4

A key to the practical understanding of radio including Frequency Modulation, Television, etc., Aircraft & Marine Radio. For radio engineers, servicemen, amateurs. 772 pages, 400 illustrations & Diagrams. Photos. Review Questions & Answers, Reference Index. Authentic, clear, concise.

AUDELS HANDY BOOK OF

PRACTICAL ELECTRICITY.....\$4

For maintenance engineers, electricians & all electrical workers. 1440 Pages, 2600 illus. Covers important electrical information in handy form—including Marine Wiring, Radio Principles, Welding, Indexed. A Key to a practical understanding of electricity.

AUDELS CARPENTERS & BUILDERS

GUIDES—4 Vols.....\$6

A practical illustrated trade assistant on modern construction for carpenters, joiners, builders, mechanics and all woodworkers. 4 vols., 1600 pages, 3700 illustrations, flexible covers. Each volume pocket size. Sold separately \$1.50 a vol.

AUDELS PLUMBERS & STEAMFITTERS

GUIDES—4 Vols.....\$6

A Practical Trade Assistant & Ready Reference. Explains in plain language & by clear illustrations, diagrams, charts, graphs, pictures principles of modern plumbing practice including Marine Pipe Fitting and Air Conditioning. 4 Vols.—1670 Pages—3842 Diagrams. Each Vol. Pocket Size. Sold Separately \$1.50 a Vol.

AUDELS WIRING DIAGRAMS.....\$1

210 Pages, illustrated. Gives practical facts on wiring of electrical apparatus. It explains clearly in simple language how to wire apparatus for practically all fields of electricity. Each diagram is complete & self-explanatory. Highly Endorsed Pocket Companion.

AUDELS ELECTRONIC DEVICES...\$2

Tells What You Want to Know About Electric Eye. Easily Understood. Covers photo-electric cells & their applications. Amplifiers, illumination, frequencies, voltage, photocell, tubes, Ohm's Law, wiring diagrams, etc.

AUDEL, PUBLISHERS, 49 W. 23 St., N. Y.



AN AUDEL GUIDE IS A GOOD FRIEND!

Use the brains and experience of others in these Guides of the Trades. Save time and money with right methods, short cuts, labor saving ideas. CHECK NOW! You can look over any Audel Guide in your home. Start the Easy Payments if satisfied.

-----CUT HERE----- MAIL ORDER

THEO. AUDEL & CO., 49 West 23rd St., New York

Please mail me for 7 days' free examination the books marked (X) below. I agree to mail \$1 in 7 days on each book or set ordered, and to further mail \$1 a month on each book or set ordered until I have paid purchase price.

If I am not satisfied with Guides I will return them.

- | | |
|--|-----|
| <input type="checkbox"/> Audels AIRCRAFT WORKER | \$1 |
| <input type="checkbox"/> Audels SHEET METAL PATTERN LAYOUTS | 4 |
| <input type="checkbox"/> Audels SHEET METAL WORKERS Handy Book | 1 |
| <input type="checkbox"/> Audels WELDERS GUIDE | 1 |
| <input type="checkbox"/> Audels ANSWERS on BLUEPRINT READING | 2 |
| <input type="checkbox"/> Audels MACHINISTS & TOOLMAKERS Handy Book | 4 |
| <input type="checkbox"/> Audels MATHEMATICS and CALCULATIONS | 2 |
| <input type="checkbox"/> Audels AUTO GUIDE | 4 |
| <input type="checkbox"/> Audels DIESEL ENGINE MANUAL | 2 |
| <input type="checkbox"/> Audels SHIPFITTERS Handy Book | 1 |
| <input type="checkbox"/> Audels RADIOMANS GUIDE | 4 |
| <input type="checkbox"/> Audels MECHANICAL Dictionary | 4 |
| <input type="checkbox"/> Audels Handy Book of PRACTICAL ELECTRICITY | 4 |
| <input type="checkbox"/> Audels CARPENTERS and Builders Guides (4 vols.) | 6 |
| <input type="checkbox"/> Audels PLUMBERS and Steamfitters Guides (4 vols.) | 6 |
| <input type="checkbox"/> Audels WIRING DIAGRAMS | 1 |
| <input type="checkbox"/> Audels ELECTRIC Dictionary | 2 |
| <input type="checkbox"/> Audels MILLWRIGHTS and Mechanics Guide | 4 |
| <input type="checkbox"/> Gueths Mechanical DRAWING Course | 1 |
| <input type="checkbox"/> Audels ELECTRONIC DEVICES | 2 |
| <input type="checkbox"/> Audels MARINE Engineers Guide | 3 |
| <input type="checkbox"/> Rogers Mechanical DRAWING and Design | 2 |
| <input type="checkbox"/> Rogers MACHINIST GUIDE | 2 |
| <input type="checkbox"/> Audels MASONS and Builders Guides (4 vols.) | 6 |
| <input type="checkbox"/> Audels ENGINEERS and Mechanical Guides | |
| Nos. 1, 2, 3, 4, 5, 6, 7 and 8 complete | 12 |
| <input type="checkbox"/> Audels Answers on PRACTICAL ENGINEERING | 1 |
| <input type="checkbox"/> Audels ELECTRICAL POWER CALCULATIONS | 2 |
| <input type="checkbox"/> Hawkins ELECTRICAL Guides at \$1 each | |
| Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 | |
| <input type="checkbox"/> Audels Answers on REFRIGERATION | 2 |
| <input type="checkbox"/> Hawkins Aids to ENGINEERS EXAMINATION | 2 |
| <input type="checkbox"/> Master PAINTER and DECORATOR | 2 |
| <input type="checkbox"/> Audels GARDENERS & GROWERS GUIDES \$1.50 a Vol. | |
| <input type="checkbox"/> Audels NEW ELECTRIC LIBRARY at \$1.50 a Volume | |
| Vols. I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XII. | |

Name.....

Address.....

Occupation.....

Employed by..... P.M.

FREE LESSON

See For Yourself How BE A RADIO

Mail the Coupon for a FREE Lesson from my Radio Course. It shows you how practical and easy to understand my lessons are—and why N. R. I. training offers a quick way to more pay. And with this free Lesson I'll send my 64-page, illustrated book, "Win Rich Rewards in Radio." It describes many fascinating types of Radio jobs; tell how you can train for them at home in spare time!

More Radio Technicians and Operators Now Make \$50 a Week Than Ever Before

There's a big shortage of capable Radio Technicians and Operators. Fixing Radios pays better now than ever before. With new Radios out of production, fixing old sets, which were formerly traded in, adds greatly to the normal number of servicing jobs.



Broadcasting Stations, Aviation and Police Radio, and other Radio branches are scrambling for Operators and Technicians. Radio manufacturers, now working on Government orders for Radio equipment, employ trained men. The Government too needs hundreds of competent civilian and enlisted Radio men and women. You may never see a time again when it will be so easy to get started in this fascinating field.

Be Ready to Cash in on Jobs Coming in Television, Electronics

Think of the NEW jobs that Television, Frequency Modulation, Electronics, and other Radio developments will open after the war! You have a real opportunity. Get into Radio NOW and be ready to cash in when Victory releases the amazing wartime Radio developments for peacetime uses!

Many Beginners Soon Make \$5, \$10 a Week EXTRA in Spare Time

Right now, probably in your neighborhood, there's room for more spare and full time Radio Technicians. Many N. R. I. Students make \$5, \$10 a week EXTRA MONEY fixing Radios in spare time while learning. I send EXTRA MONEY JOB SHEETS that tell how to do it!

Get Sample Lesson and



J. E. Smith
President,
National Radio Institute
Established 29 Years

He has directed the training of more men for the Radio Industry than anyone else.

Jump Your Pay!
Vital Jobs Go To Men I Train



\$10 a Week EXTRA in Spare Time

"I am doing spare time Radio Work, and am averaging around \$500 a year. These extra dollars mean so much—the difference between just barely getting by and living comfortably."—JOHN WASHKO, 97 New Cranberry, Hazelton, Pa.



Chief Operator, Broadcasting Station

"Before I completed your lessons, I obtained my Radio Broadcast Operator's license and immediately joined Station WMPC where I am now Chief Operator."—RODERIC F. HAYES, 327 Madison St., Lapeer, Mich.



\$200 a Month in own Business

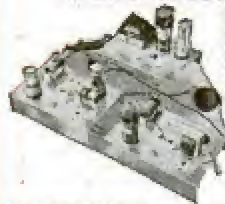
"For several years I have been in business for myself making around \$200 a month. Business has steadily increased. I have N.R.I. to thank for my start in this field."—ARCHIE J. FROEHLER, 300 W. Texas Ave., Goose Creek, Texas.



1st Lieutenant in Signal Corps

"I cannot divulge any information as to my type of work, but I can say that N.R.I. training is certainly coming in mighty handy these days." — RICHARD W. ANDERSON (Address omitted for military reasons.)

YOU BUILD THESE AND OTHER RADIO CIRCUITS WITH KITS I SEND:



SUPERHETERODYNE CIRCUIT (above) Preset, oscillator-mixer, detector, I.F. stage, diode detector-a.v.c. stage, audio stage. Bring in local and distant stations on this circuit you build yourself!

By the time you've conducted 60 sets of Experiments with Radio Parts I supply, made hundreds of measurements and adjustments, you'll have valuable PRACTICAL Radio experience for a good full or part time Radio job!

MEASURING INSTRUMENT

(right) you build early in Course. Use it in practical Radio work to make EXTRA money. Vacuum tube multimeter, measures A.C., D.C. and R.F. volts, D.C. currents, resistance, receiver output.



A. M. SIGNAL-GENERATOR (left) Build it yourself! Provides amplitude-modulated signals for test and experimental purposes. Gives valuable practice!



IN RADIO

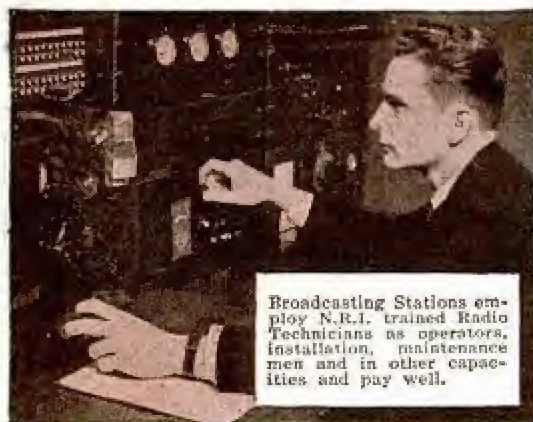
I Train You at Home to TECHNICIAN

My "50-50 Method"—half building and testing real Radio Circuits, half learning from easy-to-grasp, illustrated lessons—is a tested, proved way to learn Radio at home in spare time. Think how much

EXTRA PAY IN ARMY, NAVY, TOO

Men likely to go into military service, soldiers, sailors, marines, should mail the Coupon Now! Learning Radio helps Service men get extra rank, extra prestige, more interesting duties, much higher pay. Also prepares for good Radio jobs after service ends. Over 1,700 Service men now enrolled.

practical experience you'll get by building the "Superhet" and Measuring Instrument illustrated at left—by conducting 60 sets of experiments on these and other Circuits you build with parts I supply! Within a few months you'll be ready to run your own Spare Time Shop, fix the Radios of your friends and neighbors—get paid while learning!



Broadcasting Stations employ N.R.I. trained Radio Technicians as operators, installation, maintenance men and in other capacities and pay well.

Find Out What N.R.I. Can Do for YOU

MAIL THE COUPON BELOW for my FREE Lesson and 64-page book. They are packed with Radio facts. You'll read a description of my Course—"50-50 Method"—6 Experimental Kits—Extra Money Job Sheets. You'll see the fascinating jobs Radio offers, learn how YOU can train at home. And you'll have my free lesson to keep. No obligation—no salesman will call. Just mail Coupon at once in an envelope or pasted on penny postcard! J. E. SMITH, President, Dept. 3MP, National Radio Institute, Washington 9, D. C.

TRAINING MEN FOR VITAL RADIO JOBS

64 page Book FREE



GETTING ACQUAINTED WITH RECEIVER SERVICING

Gives You A Real Start Toward Understanding These Subjects

31 Photos, Sketches, Radio Drawings

- How superheterodyne receivers work
- How to remove tubes, tube shields
- Three reasons why Radio tubes fail
- Electrodynamic loudspeakers:
- How it works
- Replacing damaged cone
- Recentering voice coil
- Remedies for open field coil
- Output transformer construction, repair
- Gang Tuning Condensers:
- Construction of rotor, stator
- How capacity varies
- Restringing dial cord
- Straightening bent rotor plates
- I.F. transformers—What they do, repair hints
- How to locate defective soldered joints
- Inside story of carbon resistors
- Paper, electrolytic, mica, trimmer condensers
- How condensers become shorted, leaky
- Antenna, oscillator coil facts
- Power transformer: construction, possible troubles
- Installing power cord
- Troubles of combination volume control, on-off switch
- Tone controls
- Dial lamp connections
- Receiver Servicing Techniques:
- Checking performance
- Testing tubes
- Circuit disturbance test
- Isolating defective stage
- Locating defective part

MAIL COUPON NOW

J. E. SMITH, President, Dept. 3MP
National Radio Institute,
Washington-9, D. C.

Dear Mr. Smith: Mail me FREE, without obligation, your Sample Lesson and 64-page book, "Win Rich Rewards in Radio." (No salesman will call. Write plainly.)

Name..... Age.....

Address.....

City..... State..... 4 FR



More GOOD JOBS in DRAFTING

in AIRCRAFT and other War Industries!



Calls for Draftsmen Are Increasing! . . . Read the want-ads for proof of this urgent demand.

This complete drawing outfit,—everything to work with,—including drafting table, drawing board, supplies, etc.,—**ALL SENT TO YOU AT NO EXTRA COST** if you are a Chicago Tech Student.

Mail Coupon Below

The War Production program has increased the demand for Aircraft Draftsmen, Machine Draftsmen, Architectural Draftsmen, Electrical Draftsmen, and Structural Draftsmen. The Draftsman always comes first on any new project in manufacturing and industry—peace or wartime.

The Draftsman—"The Key Man" in War or Peacetime Industry

No new machines can be built, no airplanes constructed, no bridges or buildings erected, no ships or submarines launched until the draftsman has completed his work. Real immediate opportunities exist in Drafting—the profession upon which all construction is vitally dependent. Drafting is clean, interesting, well paid work. Steady employment. Investigate today what Drafting offers you! Help your country in a vital War production job on the important Home Front—and help yourself to a well paid job in Drafting.

Learn in Spare Time,—at Home!

(or at the College in Chicago)

With our easy step-by-step lessons, (and the tools we furnish), you can learn in your spare time at home. Convenient terms. To prove to you how easy it is to learn Drafting by the Chicago Tech Method we'll send you a Trial Lesson FREE. No charge for this lesson either now or later. Send a post card or the coupon now for



free TRIAL LESSON
Send Coupon

CHICAGO TECHNICAL COLLEGE

P-204 Tech. Bldg., 2000 S. Michigan Ave., Chicago 16, Ill.

Yes,—please send me **FREE Trial Lesson in DRAFTING**

- | | |
|---|--|
| <input type="checkbox"/> Aircraft Drafting | <input type="checkbox"/> Machine Drafting |
| <input type="checkbox"/> Electrical Drafting | <input type="checkbox"/> Structural Drafting |
| <input type="checkbox"/> Architectural Drafting | <input type="checkbox"/> Building Construction |

Name.....

Address.....

City.....State.....

Occupation.....Age.....

SUPER JU JITSU



NOW GET TOUGH DOUBLE-QUICK!

Learn how YOU can be dangerous. Lick brutes twice your size with only your bare hands, even when they are armed. This powerful fighting system is unbelievably efficient. You don't need ox-like muscles—it's brains that count! New, easy self-study course at amazing low price. Free-trial

offer and money-back guarantee. Hurry! Write today for FREE DETAILS. Nelson Co., 321 S. Wabash, Dept. L-502, Chicago

ENGINEERING DEGREE IN 27 MONTHS

INDIANA
TECHNICAL
COLLEGE

Courses in Aeronautical, Chemical, Civil, Electrical, Mechanical, and Radio Engineering. One-year courses in Radio and Drafting. Approved by C.A.A. Prep courses without added cost. Low tuition. Large industrial center. Opportunity to earn part living expenses. Enter Dec., Mar., June, Sept. Catalog. 5113 E. Washington Blvd., Ft. Wayne 2, Ind.



Why It Pays To

LEARN PHOTOGRAPHY NOW

Never before so many job and career opportunities! Photographers needed in business, industry, science. N.Y.I. graduates winning promotion, higher pay in Armed Forces. Qualify at America's largest, oldest school. Resident or home study. FREE catalog describes commercial, portrait, motion picture and color courses. Write today!



N. Y. INSTITUTE of PHOTOGRAPHY, Dept. 49, 19 W. 33 St., New York 1, N. Y.

ELECTRICITY MEN NEEDED

Electricians are needed everywhere. Demand is growing. Good pay now and bright future for trained men in this live, expanding vocation. Learn at home, in spare time, from old established school. Write for FREE Bulletin. No obligation.

AMERICAN SCHOOL

Dept. EE845

Drexel at 58th St.

Chicago 37



Begin today. Write now for our Free Book, "How to Become a Good Penman." It contains specimens and tells how others learned to write in spare time. Entice 10c for your name beautifully written and a pen point suitable for shaded writing. Write today.

THE TAMSLYN SCHOOL OF PENMANSHIP
X441 Ridge Building, Kansas City, Mo.



THERE'S
MONEY
IN

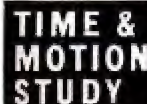
CARTOONS!

RAYE BURNS will teach you HOW to CREATE ORIGINAL CARTOONS at home that you may SELL! Course contains 25 lessons and over 600 illustrations. All for Only.....

\$2.85

Send name and address for free details.

RAYE BURNS SCHOOL, Dept. M, Box 1298, CLEVELAND 3, OHIO



TIME &
MOTION
STUDY

30 MILLION WORKERS AND SOLDIERS will compete with you in peacetime unless you train now. Low cost professional training. Time and Motion study is insurance for present and future big pay jobs. Increase vital war work now with methods improvements. Write for details now.

INDUSTRIAL ENGINEERING COLLEGE
4000 Washington, Chicago



MONEY for MEN ALL DATA FREE

THE PLASTIC Industry needs manufacturers on small scale and for big production of Lamp and Clock Stands. Art Goods and Novelties in Plastex and Marble Imitation. Experience unnecessary. Top material makes regular 10c store sellers. Rubber moulds furnished for speed production. Small investment brings good returns. WE ARE NOW PLACING BIG CHAIN STORE ORDERS WITH MANUFACTURERS. Ambitious men have chance for real prosperity. Our FREE booklet will interest and benefit you.

PLASTEX INDUSTRIES, Dept. P, 1055 Washington Av., New York 56, N. Y.

INVENTORS

NOW Is the Time to PATENT and SELL Your Invention

Now, more than ever before, is the right time to patent your invention. Why? Because manufacturers everywhere presently engaged in war production are looking ahead to the future by buying up patent rights now, so they will have new and attractive items to make and sell for civilian consumption as soon as the war is over. This is what happened during and after the last war. Hence, the smart thing for you to do is to look ahead to the future too. Protect your invention by applying for a patent now, so you will be in position to cash in on an outright sale, or on the royalties your invention will bring.

Patent Guide Shows What To Do

Our "Patent Guide for the Inventor" answers many important questions concerning Patents that inventors constantly ask. It tells what facts, details, drawings, sketches, etc. are necessary to apply for a Patent; how to protect your invention through dated and witnessed disclosure; how to do this AT ONCE to safeguard your rights; how Patent Office Records can be checked to determine whether the invention is probably patentable before filing fees need be paid; discusses costs involved and a practical way these can be paid as the application progresses. It tells how some inventors secured financial backing; how many simple inventions have proved large commercial successes; how Patents covering improvements also can be profitably utilized and marketed; tells countless other facts of interest.

Why You Need Expert Assistance

The Patent Laws were enacted for your benefit—to give you protection for the features of your invention which are Patentable. But these features must be legally and concisely set forth in the form of "claims." This phase of the procedure is so complex that the Patent Office advises the Inventor to engage a competent Registered Patent Attorney. We maintain a large staff—carefully trained registered patent attorneys—expert draftsmen—experienced searchers—to serve you. We have been serving inventors for more than 20 years.

Take First Step Now

With the Patent Guide you will receive also Free a "Record of Invention" form which will enable you at once to establish the date of your invention, before you file your Patent application. This step costs you nothing yet may be vital to your success. Remember—in Patent Matters, ACTION IS IMPORTANT. Delay can be costly. Mail the coupon in an envelope, or paste it on a penny postcard NOW.

CLARENCE A. O'BRIEN & HARVEY B. JACOBSON

"Worthy of your Trust"

Registered Patent Attorneys
31-L Adams Building
Washington, D. C.

Get This
FREE BOOK

IMMEDIATELY MAIL COUPON TODAY!

Get
**FREE
COPY**



**CLARENCE A. O'BRIEN
& HARVEY B. JACOBSON**

CLARENCE A. O'BRIEN & HARVEY B. JACOBSON
Registered Patent Attorneys before the United States Patent Office
31-L Adams Building, Washington, D. C.

Please send me your 48-Page "Patent Guide for the Inventor" and your specially prepared "Record of Invention" form FREE. This request does not obligate me.

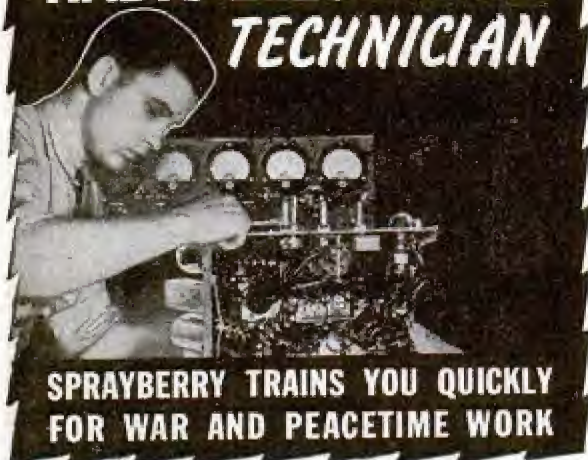
Name _____

Address _____

City _____ State _____

(Please write or print plainly.)

HERE IS YOUR SUCCESS CHANCE BE A RADIO-ELECTRONIC TECHNICIAN



YOU LEARN IN EASY STEP-BY-STEP STAGES No Previous Experience Needed

The offer I make you here is the opportunity of a lifetime. It's your big chance to get ready for a wonderful future in the swiftly expanding field of Radio-Electronics INCLUDING Radio, Television, Frequency Modulation, and Industrial Electronics. Be wise! NOW is the time to start. Aside from future considerations, just think of the IMMEDIATE possibilities in Radio during war time. They're tremendous! Best of all, it's easy for the beginner to get started through my quick, practical training.

PREPARES YOU for a BUSINESS of YOUR OWN ... or Good Radio Jobs, Civilian or Military

The Sprayberry course is short, intensive, and interesting. It starts right at the beginning of Radio. You can't get lost. It gets the various subjects across in such a clear, simple way that you understand and remember. I make it easy for you to learn Radio Set Repair and Installation Work . . . by practical, proved, time tested methods. I teach you how to install and repair Electronic Equipment, and give you the broad fundamental principles so necessary as a background no matter what branch of Radio you wish to specialize in. Soon you'll be qualified for a good paying job in one of the nation's Radio plants doing war work OR, if you enter the Army, Navy, or Marines, my training will help you win higher rating and better pay. Let me prove what Sprayberry training can do for you.



JUST OFF THE PRESS!

**YOURS FREE THESE
TWO VALUABLE
BOOKS!**



"How to Test and Repair Radio Sets Without Meters"

Developed in the Sprayberry Laboratory, this instructive volume tells about an amazingly simple, yet efficient method for Radio trouble-shooting and repair without use of regular equipment made scarce due to war. Send for this FREE book now while the supply lasts and along with it, I will send you another big FREE book describing my Radio-Electronic training. Use coupon below.

MAIL COUPON

SPRAYBERRY ACADEMY OF RADIO
F. L. Sprayberry, President
610-L University Place, N. W., Washington (9), D. C.
Please rush my FREE copies of "How to TEST and REPAIR RADIO SETS WITHOUT METERS" and "How to MAKE MONEY in RADIO"

Name..... Age.....
Address.....
City..... State.....
(Mail in plain envelope or paste on penny postcard)

I'll Train You for a Better Pay JOB in DRAFTING ... Right in your Home

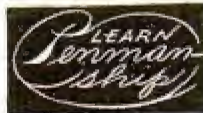


All working tools, including drawing table, sent to you at once—furnished free with course.

ENGINEER DOBE, Div. 3378, Libertyville, Illinois

STAMMER?

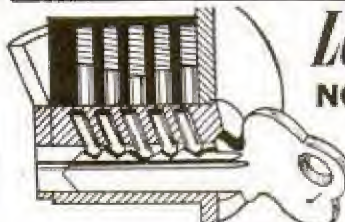
This new 128-page book, "Stammering, Its Cause and Correction," describes the Bogue Unit Method for scientific correction of stammering and stuttering—successful for 42 years. Free—no obligation. Benjamin N. Bogue, Dept. 1806, Circle Tower, Indianapolis, Ind.



Write for my Free Book, "How to Become an Expert Penman," which shows what others have accomplished by taking my Course. Enclose 10c for one of my Favorite Pen Points and your name with a beautiful flourish written on a card. Write today.
T. M. TEVIS, Box 25K, Chillicothe, Mo.

Get into the BAKING BUSINESS

Bakers make good money! Now 7th Industry in wages! Nearly depression-proof. New home study Baking Course qualifies you. Common school education sufficient. If you're ambitious, write for FREE BOOK, "Opportunities in Baking." National Baking School, 1315 Michigan, Dept. 1358, Chicago



Locksmithing NOW MADE EASY!

New course for practical men, mechanics, carpenters, fix-it shops, etc. Learn to fit keys, pick locks, de-codes, make masterkeys. It pays. Send name for FREE details. No obligation—write today! Nelson Co., 321 S. Wabash, Dept. 702-L, Chicago.

POWERFUL VISION — LONG RANGE



6—POWER TELESCOPE \$2.49

Perfect for spotting ships, planes; watching sporting events, people, birds, etc. Genuine black life-time plastic eyepieces with scientifically-ground 33 mm. lens. Objects 600 yards away appear as 100 yds. distant. Simple to focus on both moving and stationary objects. 15 DAYS FREE TRIAL. If not fully satisfied, return for refund. SEND NO MONEY. Just pay postman \$2.49 plus few cents postage on delivery. Cash orders sent postpaid! Don't wait—production of telescopes may be curtailed as it has been on binoculars. Vogue Telescope Co., 7759 S. Halsted, Dept. B-409, Chicago

LEARN MONEY PAINTING PORTRAITS

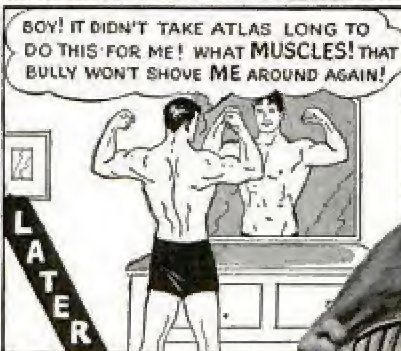
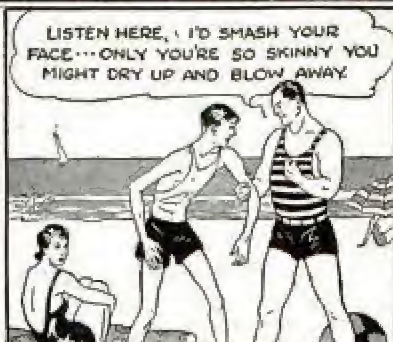


• No previous training or talent necessary. Unique Stuart System teaches you, by mail, in 10 simple, easy-to-follow lessons, to make excellent charcoal and oil likenesses. Detailed guidance for your every step. Send for free book today.

STUART 121 Monument Circle, Rm. 6113, Indianapolis 9, Ind. STUDIOS, Please send me free book and outline of lessons.

Name.....
Street.....
City..... State.....

HOW JOE'S BODY BROUGHT HIM FAME INSTEAD OF SHAME



I Can Make YOU A New Man, Too in Only 15 Minutes A Day!

If YOU, like Joe, have a body that others can "push around"—if you're ashamed to strip for sports or a swim—then give me just 15 minutes a day! I'll PROVE you can have a body you'll be proud of, packed with red-blooded vitality! "Dynamic Tension." That's the secret! That's how I changed myself from a spindleshanked, scrawny weakling to winner of the title, "World's Most Perfectly Developed Man."

"Dynamic Tension" Does It!

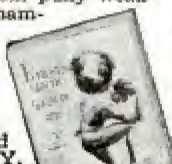
Using "Dynamic Tension" only 15 minutes a day, in the privacy of your own room, you quickly begin to put on muscle, increase your chest measurements, broaden your back, fill out your arms and legs. Before you know it, this easy, NATURAL method will make you a finer speci-

men of REAL MANHOOD than you ever dreamed you could be! You'll be a New Man!

FREE BOOK

Thousands of fellows have used my marvelous system. Read what they say—see how they looked before and after—in my book, "Everlasting Health And Strength."

Send NOW for this book—FREE. It tells all about "Dynamic Tension," shows you actual photos of men I've turned from puny weaklings into Atlas Champions. It tells how I can do the same for YOU. Don't put it off! Address me personally: Charles Atlas, Dept. 811, 115 East 23rd St., New York 10, N. Y.



Charles Atlas

—actual photo of the man who holds the title, "The World's Most Perfectly Developed Man."

CHARLES ATLAS, Dept. 811, 115 East 23rd St., New York 10, N. Y.

I want the proof that your system of "Dynamic Tension" will help make a New Man of me—give me a healthy, husky body and big muscular development. Send me your free book, "Everlasting Health and Strength"

Name..... (Please print or write plainly)

Address.....

City..... State.....

☐ Check here if under 16 for Booklet A

INVENTORS

BOOK

and INVENTION RECORD (Cost You Nothing) FREE BOOK



HOW TO PROTECT, FINANCE and SELL YOUR INVENTION

Our **FREE BOOK** and other literature available to our clients—gives you complete details on how to "ready" your invention for money-making. It tells you how others did it—who they went to for finances—how they arranged partnerships—how they made contacts with manufacturers—how they dictated royalty arrangements—how much money they made—how you can find a market. Our new **FREE BOOK** discloses sources of quick revenue if your invention is patentable and saleable with profit possibilities.

THE FIRST STEP

The first step in getting your invention ready for market is to make a dated record of it on our "Invention Record" Form. This Form properly filled out and witnessed will be invaluable to you later in establishing the date of your invention should need for such evidence arise. We will be glad to send you our "Invention Record," and have it witnessed in this office when you return it with disclosure of your device. This service costs you nothing—and it immediately puts you on record as the originator of your device.

Protect Your Invention NOW!

We have many letters in our files from manufacturers requesting inventions. Today's demand for new devices is tremendous—added to by emergency needs. Protect your invention now with a U. S. Patent. By acting promptly you may prevent another inventor getting in ahead of you at the Patent Office here in Washington. The first step is to make a sketch and description of your invention on our "Invention Record," have it witnessed and mail it to us. We will then make a Search of the U. S. Patent Office files to ascertain whether we can get patent protection for you. This is a step you should make NOW—before another steps in ahead of you and walks away with a patent.

MAIL

COUPON TODAY!

McMORROW & BERMAN
PATENT ATTORNEYS
135-M Albee Building
Washington 5, D. C.

Send me your NEW FREE Book "How To Protect, Finance and Sell Your Invention" and specially prepared "Invention Record" form at once. I understand that this request does not obligate me.

NAME

ADDRESS

CITY..... STATE.....

Write or Print Name Clearly

Say you saw it in Popular Mechanics!

"YOU ARE UNDER ARREST!"



There's a Thrill
in Bringing a
Crook to Justice
Through Scientific

CRIME DETECTION

I have taught thousands of men and women this exciting, profitable, pleasant profession. Let me teach you, too, in your own home. Prepare yourself in your leisure time to fill a responsible, steady, well-paid position in a very short time and at very small cost. What others have done, you too, can do.

53% of All American Identification Bureaus

Be A
**FINGER
PRINT
Expert**

Employ students or graduates of I.A.S. This fascinating work is easy to learn and the training is inexpensive. You, too, can fit yourself to fill a responsible crime detection job with good pay and steady employment. But don't delay—get the details now. Let me show you how easily and completely I can prepare you for this fascinating work, during spare time, in your own home. You may pay as you learn. Write today for free Crime Book.

FREE! "THE BLUE BOOK OF CRIME"

It's a thriller. Tells about some of the most interesting crimes ever perpetrated and how they were solved through the very methods taught by I.A.S. Send now—be sure to state age.

INSTITUTE OF APPLIED SCIENCE
Dept. 1358, 1920 Sunnyside Ave., Chicago, Illinois

LAW

STUDY AT HOME

Legally trained men win higher positions and bigger success in business and public life. Greater opportunities now than ever before. Big corporations are beset by men with legal training.

More Ability: More Prestige: More Money

We guide you step by step. You can train at home during spare time. Degrees of LL. B. Successful graduates in every section of the U. S. We furnish all text material, including 14-volume Law Library, Law text, easy terms. Get our valuable 48-page "Law Training for Leadership" and "Evidence" books FREE. Send for them NOW.
LaSalle Extension University, Dept. 1164-L Chicago
A Correspondence Institution

STUDY AT HOME

With A Chartered Educational Institution

Courses in **ENGINEERING**: Electrical, Civil, Mechanical, Drafting, Architectural, Steam, Aeronautical, Radio, Structural, Mining, Industrial, Highway, Petroleum, Marine, Chemical.

Courses in **ARTS AND SCIENCES**: Philosophy; Education; Letters; Public Health; Medical Jurisprudence; Psychology; Sociology; Physics; Chemistry; Geology; Pol. Science; Theology; Law; Business and Commerce; Accounting; Mathematics; Statistics; Agriculture.

McKinley-Roosevelt Incorporated, 4610-UC, Sheridan Road, Chicago, 40

Short-Cut Mathematics COMBINED WITH Practical Mechanics Simplified

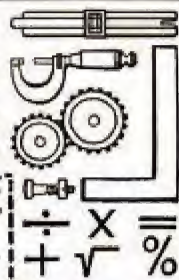
NEW 2-in-1 reading course! Now you can learn the speedy, simplified system of calculation used by draftsmen, engineers, accountants, "master minds" on the stage. Learn easy way to multiply 4 figures by 4 figures without using old-fashioned multiplication; add long columns of figures this lightning short-cut method. Learn horsepower, slide rule, micrometer, logarithms, wood measure, puzzles, etc., etc. Large illustrated volume complete with answers. Satisfaction or refund. Amaze friends with your magic-like mental powers. Complete details... mail coupon TODAY!

FREE

Nelson Co., 321 S. Wabash, Dept. L-300, Chicago
Please send free details about "Short-Cut Mathematics and Practical Mechanics Simplified." No obligation.

Name

Address



How to pass a genius



All of us can't be geniuses. But any ordinarily talented mortal can be a success—and that's more than some geniuses are.

Now, as in Æsop's time, the race doesn't always go to the one who potentially is the swiftest. The *trained* man has no trouble in passing the genius who hasn't improved his talents.

In war and peace, in every technical and business field, the *trained* man is worth a dozen untrained ones, no matter how gifted.

The International Correspondence Schools can't make you into a genius. For more than 50 years, however, I. C. S. has been helping its students to become *trained, successful leaders*—and it can do the same for you.

Mark your special interest on the coupon. Don't be like the unsuccessful genius who wastes his life in dreaming of what he intends to do. *Act now!*

SPECIAL
TUITION RATES
FOR MEMBERS
OF THE
ARMED FORCES
★

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 5676-J, SCRANTON 9, PENNA.

Explain fully about your course marked X:

TECHNICAL AND INDUSTRIAL COURSES

- | | |
|---|--|
| <input type="checkbox"/> Air Brake | <input type="checkbox"/> Marine Engines |
| <input type="checkbox"/> Air Conditioning | <input type="checkbox"/> Mechanical Engineering |
| <input type="checkbox"/> Airplane Drafting | <input type="checkbox"/> Navigation <input type="checkbox"/> Plastics |
| <input type="checkbox"/> Architecture <input type="checkbox"/> Boilermaking | <input type="checkbox"/> Patternm'k'g <input type="checkbox"/> Plumbing |
| <input type="checkbox"/> Auto Technician <input type="checkbox"/> Aviation | <input type="checkbox"/> Public Works Engineering |
| <input type="checkbox"/> Blueprint Reading | <input type="checkbox"/> Radio Operating |
| <input type="checkbox"/> Bridge Engineering | <input type="checkbox"/> Radio Servicing |
| <input type="checkbox"/> Chemistry <input type="checkbox"/> Coal Mining | <input type="checkbox"/> R. R. Engineering |
| <input type="checkbox"/> Civil Engineering | <input type="checkbox"/> R. R. Section Foreman |
| <input type="checkbox"/> Diesel Engines | <input type="checkbox"/> R. R. Signalman |
| <input type="checkbox"/> Drafting | <input type="checkbox"/> Refrigeration |
| <input type="checkbox"/> Electrical Drafting | <input type="checkbox"/> Sheet Metal Work |
| <input type="checkbox"/> Electr'n <input type="checkbox"/> House Planning | <input type="checkbox"/> Ship Draft'g <input type="checkbox"/> Shipfitting |
| <input type="checkbox"/> Foundryman <input type="checkbox"/> Heating | <input type="checkbox"/> Steam Elect. <input type="checkbox"/> Steam Eng. |
| <input type="checkbox"/> Heat Treatment of Metals | <input type="checkbox"/> Structural Engineering |
| <input type="checkbox"/> Highway Engineering | <input type="checkbox"/> Surveying and Mapping |
| <input type="checkbox"/> Industrial Metallurgy | <input type="checkbox"/> Telegraphy <input type="checkbox"/> Telephony |
| <input type="checkbox"/> Locomotive Engineer | <input type="checkbox"/> Toolmak'g <input type="checkbox"/> Tool Design |
| <input type="checkbox"/> Machinist <input type="checkbox"/> Inspector | <input type="checkbox"/> Welding, Electric & Gas |

BUSINESS COURSES

- | | |
|--|--|
| <input type="checkbox"/> Advertising <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Foremanship |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> High School <input type="checkbox"/> Illustrating |
| <input type="checkbox"/> Cartooning <input type="checkbox"/> Civil Service | <input type="checkbox"/> Show Card, Sign Lettering |
| <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> Railway Postal Clerk |
| <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Commercial | <input type="checkbox"/> Secretarial <input type="checkbox"/> Spanish |
| <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> Traffic Management |

HOME ECONOMICS COURSES

- | | |
|---|---|
| <input type="checkbox"/> Advanced Dressmaking | <input type="checkbox"/> Professional Dressmaking and Designing |
| <input type="checkbox"/> Foods and Cookery | <input type="checkbox"/> Tea Room Management |
| <input type="checkbox"/> Home Dressmaking | |

Name.....Age.....

Address.....

City.....State.....

Present Position.....

Canadian residents send coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada.
British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England.

INTERNATIONAL CORRESPONDENCE SCHOOLS

BOX 5676-J, SCRANTON 9, PENNA.

Explain fully about your course marked X:

TECHNICAL AND INDUSTRIAL COURSES

- | | |
|---|--|
| <input type="checkbox"/> Air Brake | <input type="checkbox"/> Marine Engines |
| <input type="checkbox"/> Air Conditioning | <input type="checkbox"/> Mechanical Engineering |
| <input type="checkbox"/> Airplane Drafting | <input type="checkbox"/> Navigation <input type="checkbox"/> Plastics |
| <input type="checkbox"/> Architecture <input type="checkbox"/> Boilermaking | <input type="checkbox"/> Patternm'k'g <input type="checkbox"/> Plumbing |
| <input type="checkbox"/> Auto Technician <input type="checkbox"/> Aviation | <input type="checkbox"/> Public Works Engineering |
| <input type="checkbox"/> Blueprint Reading | <input type="checkbox"/> Radio Operating |
| <input type="checkbox"/> Bridge Engineering | <input type="checkbox"/> Radio Servicing |
| <input type="checkbox"/> Chemistry <input type="checkbox"/> Coal Mining | <input type="checkbox"/> R. R. Engineering |
| <input type="checkbox"/> Civil Engineering | <input type="checkbox"/> R. R. Section Foreman |
| <input type="checkbox"/> Diesel Engines | <input type="checkbox"/> R. R. Signalman |
| <input type="checkbox"/> Drafting | <input type="checkbox"/> Refrigeration |
| <input type="checkbox"/> Electrical Drafting | <input type="checkbox"/> Sheet Metal Work |
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Ship Draft'g <input type="checkbox"/> Shipfitting |
| <input type="checkbox"/> Electr'n <input type="checkbox"/> House Planning | <input type="checkbox"/> Shop Practice |
| <input type="checkbox"/> Foundryman <input type="checkbox"/> Heating | <input type="checkbox"/> Steam Elect. <input type="checkbox"/> Steam Eng. |
| <input type="checkbox"/> Heat Treatment of Metals | <input type="checkbox"/> Structural Engineering |
| <input type="checkbox"/> Highway Engineering | <input type="checkbox"/> Surveying and Mapping |
| <input type="checkbox"/> Industrial Metallurgy | <input type="checkbox"/> Telegraphy <input type="checkbox"/> Telephony |
| <input type="checkbox"/> Locomotive Engineer | <input type="checkbox"/> Toolmak'g <input type="checkbox"/> Tool Design |
| <input type="checkbox"/> Machinist <input type="checkbox"/> Inspector | <input type="checkbox"/> Welding, Electric & Gas |

BUSINESS COURSES

- | | |
|--|--|
| <input type="checkbox"/> Advertising <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Foremanship |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> High School <input type="checkbox"/> Illustrating |
| <input type="checkbox"/> Cartooning <input type="checkbox"/> Civil Service | <input type="checkbox"/> Show Card, Sign Lettering |
| <input type="checkbox"/> C. P. Accounting | <input type="checkbox"/> Railway Postal Clerk |
| <input type="checkbox"/> College Preparatory | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Commercial | <input type="checkbox"/> Secretarial <input type="checkbox"/> Spanish |
| <input type="checkbox"/> Cost Accounting | <input type="checkbox"/> Traffic Management |

HOME ECONOMICS COURSES

- | | |
|---|---|
| <input type="checkbox"/> Advanced Dressmaking | <input type="checkbox"/> Professional Dressmaking and Designing |
| <input type="checkbox"/> Foods and Cookery | <input type="checkbox"/> Tea Room Management |
| <input type="checkbox"/> Home Dressmaking | |

Name.....Age.....

Address.....

City.....State.....

Present Position.....

Canadian residents send coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada.
British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England.

Both
coupons
are the
same.
Use
either.
Hand
the
other
to a
friend.

INVENTORS

YOU'VE NEVER HAD A GREATER
Opportunity!

GET THESE BOOKS--THEY'RE FREE--THEY TELL YOU WHAT TO DO

Many Patents...If Secured Now...Have 3-Fold Chance to Become Profitable

Do you realize the value of your labor-saving or time-saving device . . . your improvement on a machine . . . your gadget that does some job better or does a job automatically that has never been done before? Man—then think this over!

NOW is the time to have your application prepared and prosecuted because American manufacturers are planning their coming peacetime production while they are out-producing the Axis. Thus—if your invention will help win the war, your Government may adopt it. Or—one or more war goods manufacturers may use it. Then—when peace comes—many opportunities may present themselves. Even if your invention is for peacetime use only—DON'T WAIT. Cash in on the present wave of "post-war" thinking. WHAT-EVER YOUR INVENTION—THERE IS NO BETTER TIME THAN THE PRESENT TO DO SOMETHING ABOUT IT.

GET THESE BOOKS—THEY'RE FREE—THEY TELL YOU WHAT TO DO

These two big books—"Patent Protection" and "When and How to Sell Your Invention" have helped many inventors to success. They can help you! Sixty-eight pages of valuable information and guidance, well illustrated. Show details of 115 Mechanical movements. They may be just what you need to complete your invention.

Use the coupon NOW—while it's fresh in your mind. We'll rush the books to you with free "Evidence of Invention" form that will help you establish your claim.



SUCCESS COMES TO THOSE WHO ACT!
SEND THIS COUPON TODAY—

VICTOR J. EVANS & Co.

Registered Patent Attorneys for Nearly 50 years
730-M MERLIN BUILDING • WASHINGTON, D. C.

Please send me your books "Patent Protection" and "When and How to Sell your Invention"—also important "Evidence of Invention" form, without cost or obligation.

Name.....

Address.....

City and State.....

HOW WE CAN HELP YOU

A thoroughly trained staff here at Victor J. Evans & Co., competently takes care of all the details for you . . . a procedure followed by many inventors. The experience of this staff is your assurance that your patent application will be prepared in the proper manner and speedily pushed to a conclusion. We've served men like you for nearly fifty years.

AVIATION

FOR YOUR CAREER PLUS WAR SERVICE



Both

AT THE SAME TIME

Before you are 18, MAKE YOURSELF THE KIND OF MAN THE AVIATION INDUSTRY OR THE AIR SERVICES WANT . . . THE KIND THEY CANNOT DO WITHOUT . . . so you can ADVANCE RAPIDLY. Since 1929, Curtiss-Wright Tech has been specializing in modern and progressive training for Aeronautical Engineers and Master Aviation Mechanics. (No flying involved.) Write for full information. Include name, address and date of birth. Dept. PM-11



CURTISS TECHNICAL **WRIGHT INSTITUTE**

GRAND CENTRAL AIR TERMINAL
Glendale (Los Angeles Co.) California

THIS TOWER OVERLOOKS AVIATION'S MOST DISTINGUISHED SCHOOL OF AERONAUTICS

FREE BARGAIN CATALOG of BOOKS

25,000 books of all publishers listed in our 49th Annual Bargain Catalog of 320 pages. Old-time favorites—latest "best sellers." Reference, Fiction, Juvenile, History, Scientific, etc. Supplying schools, colleges, libraries and thousands of individual customers. Send postcard today for our new 1944 catalog, "Bargains in Books."

THE BOOK SUPPLY COMPANY, Dept. 138
564-566 West Monroe Street Chicago, Illinois

ARTISTS MAKE MONEY

Find out your ability. Send name, age, occupation and address for Free Vocational Art Test.

ART INSTRUCTION, INC. (Formerly Federal Schools)
1133 Art Instruction Building, Minneapolis, Minnesota

PLASTICS ENGINEERING

Wartime applications have proved the peacetime possibilities of PLASTICS. Get ready now for this big postwar opportunity. Prepare yourself for a highly paid position in Plastics Industrial Engineering. Complete home training course now available. Send name and state age.

OHIO INSTITUTE OF TECHNOLOGY, Box 128, Greenville, Ohio

730 SHAVES FROM 1 BLADE

AMAZING NEW BLADE SHARPENER

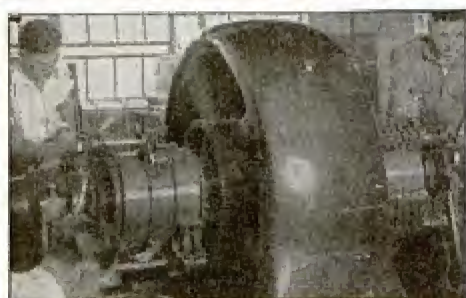


New sharpener for all makes of double-edge razor blades performs miracles! "Not necessary to change blades," writes one user. Another says, "I have used 1 blade over 730 times." RAZOROLL really sharpens blades because it strokes on leather. Gives keen, smooth shaving edges. No guesswork. Blade held at correct angle and proper pressure—automatically. Just turn crank to sharpen. No gears. Well made. Handsome, compact, sturdy. Weighs few ounces. Will last years. Makes ideal gift.

Only \$1.00

SEND NO MONEY! Write today. Pay postman only \$1 plus few cents postage. Use RAZOROLL for 5 days and if you're not delighted with your dollar. Hurry—order today. RAZOROLL COMPANY
620 North Michigan Avenue, Dept. 5011, Chicago, Illinois

MEN! Whether You are 16 or up to 50
Serve Your Country Best... in a
GOOD WAR-TIME JOB
WITH A PEACE-TIME FUTURE!



★ **ELECTRICITY** is one of the most important factors in our war effort. Thousands of trained Electricians are needed NOW. And after the war, Electricity will continue to be tremendously important! Why be satisfied with a no-future job when I make it SO EASY to prepare for a good war-time and peace-time job with a REAL FUTURE?



FIRST IN WAR! ELECTRICITY FIRST IN PEACE!

Learn By Doing in 12 Weeks

Get into the fascinating, fast-growing, well-paid field of Electricity—a field that offers you opportunities and a future—in good times or bad times—a field that is a permanent necessity in war or peace. Here is your chance to prepare yourself for a lasting permanent future.

Here at Coyne, in 12 weeks, you can train for your Big Opportunity. "Learn-by-doing"

SPECIAL OFFER!
RADIO and
ELECTRONICS

New Course Now Included!
 No extra cost!



—train on real electrical machinery. Not a correspondence course. Here you learn airplane ignition, wind armatures, learn power plant operation, do house and factory wiring, etc.

Coyne training is easy to learn. You don't need previous experience or advanced education. You don't need much money to get my training. I have many plans to help the fellow who needs training but hasn't much money. Mail coupon for all the facts.



H. C. Lewis

GET YOUR TRAINING NOW... PAY FOR IT LATER!

LIFETIME JOB SERVICE
 Free to Coyne Graduates!

Coyne Training is EASY, PRACTICAL! You LEARN BY DOING on real, actual machinery and apparatus. Don't let lack of money stop you. You can get training first—then pay for it in easy monthly payments after you graduate. If you need part-time work to help out with living expenses, I'll help you get it.

INSURE YOUR FUTURE! Send for Book!

Coyne is 45 years old and has seen War and Peace—times of prosperity and times of national depression. During all these times Coyne has trained men for good pay jobs. Coyne training is tested and proven. Mail coupon and let me send you the big free Coyne book and my complete story about how I help you get the training you need for a good Electrical job. This does not obligate you. So act at once. Just mail coupon.

H. C. LEWIS, President
COYNE ELECTRICAL SCHOOL
 500 S. Paulina St. Dept: 83-72 Chicago 12, Illinois

H. C. LEWIS, President
 COYNE ELECTRICAL SCHOOL, Dept. 83-72
 500 S. Paulina St., Chicago 12, Illinois

Send me your Free Book and tell me about your plans to help me—including Pay-Tuition-after-Graduation offer and Radio-Electronics Training at no extra cost.

NAME.....
 ADDRESS.....
 CITY..... STATE.....

SHEET METAL INFORMATION ON LAYOUTS

SIZE 7" x 10" x 3"
1125 PAGES



NOW READY!

A practical, illustrated Encyclopedia covering all phases of Sheet Metal Work including Pattern Cutting, Pattern Development, and Shop Procedure—Developed by experts for Sheet Metal Workers, Layout Men, Mechanics, and Students.

1001 KEY FACTS AT YOUR FINGER ENDS

10 Big Sections, 350 Layouts, 1600 Illust. FULLY INDEXED FOR READY REFERENCE in answering your layout problems. Easy to read and understand. Well printed in clear type. Flexible covers.

\$4 COMPLETE • PAY ONLY \$1 A MO.
To get this assistance for yourself simply fill in and mail order today.

AUDEL Publishers, 49 West 23rd St., New York
Mail AUDEL'S SHEET METAL PATTERN LAYOUTS BOOK. Price \$4 on 7 Days Free Trial, if O. K. I will remit \$1 in 7 days and \$1 monthly until \$4 is paid. Otherwise I will return it.

NAME _____

ADDRESS _____

OCCUPATION _____

REFERENCE _____ PM

Sent FREE for 7-Day Trial MACHINE SHOP TRAINING COURSE



Machine Tools fully described, demonstrated. Lessons in all kinds of bench work. Instructions to tool up, operated machines. Hundreds of short cuts. Enable you to get Expert's Pay.

FOR BEGINNERS & EXPERTS
Easiest, Quickest Way to Get

MACHINIST TRAINING

Compiled by practical machine shop experts—"Modern Machine Shop Training"—Shipped absolutely FREE for 7-day examination. Actual Lesson Assignments, shop tested, with same training principles and instruction as given students in our huge Los Angeles shops. Hundreds of illustrations, diagrams, charts, tables. Beginners and experts need this proved Course. Mail Coupon at once and also receive FREE, 7 Drafting Lessons, Machinist's Dictionary and 2 Shop Math. Texts.

NATIONAL SCHOOLS
Los Angeles, Calif.



3 BIG VOLUMES—SEND NO MONEY

NATIONAL SCHOOLS, Dept. K-11
4000 S. Figueroa St., Los Angeles 37, Calif.
Ship your 3-VOLUME MODERN MACHINE SHOP TRAINING COURSE postpaid. Within 7 days after receiving Course (and Bonus GIFT) I will either return shipment, and owe you nothing; or if satisfied, I'll send \$3.00, and \$3.00 a month until total of \$12.50 is paid (final payment, \$3.50). You may deduct \$1.25 if you enclose cash (\$11.25) with this Coupon. Same return privilege.

NAME _____

ADDRESS _____

CITY _____ STATE _____

OCCUPATION _____ AGE _____

WANTED: IDEAS!

FOR POST-WAR PRODUCTS

Household Appliances

Electrical and Electronic Devices

Hand Tools and Equipment

We are authorized to seek out and recommend products of merit as above for manufacturers now engaged in war work. If you have an idea for one or more products in either of the above groups, which you feel has possibilities, write us today. We prefer ideas that have been developed to the "patent-applied-for" stage.

Please do not send sketches or descriptive material on your idea unless you have protected yourself by patent application. If you do not think enough of your idea to apply for a patent, then it would scarcely interest us.

If you do send sketches or descriptive material, put them in a sealed envelope and attach to it a letter authorizing us to inspect your sketches or descriptive material without obligation. Enclose your letter and sealed envelope in regular mailing envelope and mail first class. All mail will be opened in the presence of witnesses. Unless your letter authorizes us to look at your sketches, the sealed envelope containing your sketches will be returned unopened.

This is a real effort to locate worthwhile products in the above fields. If your idea appeals to our clients, a sincere effort will be made to arrive at mutually satisfactory financial arrangements.

INDUSTRIAL ENGINEERING CO.

3120 MONROE ST., TOLEDO 6, OHIO

★ TRAIN for SUCCESS in the Poultry Business



Study at home in spare time. Earn extra while learning. . . .

YOU CAN MAKE MORE MONEY FROM POULTRY. Whether you keep 10 birds or ten hundred, get latest scientific methods that avoid losses, increase profits. Our famous system of Home Study Training has helped thousands to success. Extra profits from the start. FREE Catalog; describes courses, methods, service. Write today to Dept. 50-P.

NATIONAL POULTRY INSTITUTE, Adams Center, N. Y.

Learn CARTOONING



FREE TRIAL LESSON! Cash in on your sense of humor—AT HOME—BY MAIL. Have fun! Make money! No experience needed to start. Write today for FREE LESSON, mailed postpaid. No obligation.
Meon Gag-Cartoon School, Dept. M, Argyle, Wisconsin.



RADIO Made Easy

DO RADIO WORK IMMEDIATELY
Begin doing practical radio work with the first chapter. Use any small home-radio for many instructive, safe experiments. Learn how to test radio sets and parts. Simplified, picture-clear explanations make basic radio knowledge easy to understand and to apply. Repair radios for fun and profit. Get a well-paying radio war-job. Earn higher rank and pay in the Army.

GET PRACTICAL RADIO TRAINING

This amazing, different home-study manual will teach you quickly to do radio work. At first you will learn about parts, tubes, tests, simple circuits. Later chapters cover receivers, transmitters, testers, trouble-shooting. New, up-to-date, 1943 edition, includes material on Electronics and Radar. Follows U. S. Office of Education outline.

NEW—JUST OUT
336 large pages
Over 300 pictures
Manual binding
Leatherette cover

SEND NO MONEY—USE 10 DAYS
Examine the complete Practical Radio Manual for 10 days, without risk or obligation. See how easy it is to learn radio this new way. Send no money. Simply pay your mailman only \$2.95, plus a few cents postage. You must be satisfied or your money will be refunded in full. Write today.

SUPREME PUBLICATIONS, 328 S. JEFFERSON ST., CHICAGO 6, ILL.

PLASTICS

THE GREAT *New* FIELD OF OPPORTUNITY
PLASTICS ENGINEERS AND TECHNICIANS NEEDED
IN NOT ONE BUT MANY CLASSES OF INDUSTRY

● Leaders in science and industry have long been saying, "Keep your eye on Plastics." But now the time for action has arrived. The future of huge possibilities has already begun. Developments in Plastics for hundreds of wartime uses have set the pace for revolutionary changes in peacetime production of thousands of products.

THIS IS YOUR BIG CHANCE

Today there's a big need in vital war production for those who are trained in Plastics. From one to a hundred articles made of Plastics must be supplied for every man in our fighting forces. Start training now in Plastics Engineering, in spare time in your own home. Fit yourself for a responsible, well-paid position. Help to win Victory. And at the same time you will be preparing for even greater opportunities when the war is over.

There is scarcely an industry in which these so-called "miracle materials" will not play an important part. After the war many old materials, methods and skills will be replaced. Acquire the all-important "know how." Be in a position to step into one of the key jobs.

YOU CAN LEARN WHILE YOU EARN

Turn at least part of your leisure time into money. Qualify at home for a larger income in an interesting career. Build greater security for your future in a vocation that looms large on the horizon of the new industrial era. Hours you might otherwise waste can put you well on your way toward lasting success.

It's easy to find out about Plastics training. To get details and outline of study prepared by specialists, and about the school that has helped thousands to success during the past 46 years, write us or check and mail the coupon. Send today. The sooner you take this easy step, the sooner you will reach your goal and reap the rich rewards.

AMERICAN SCHOOL OFFERS COMPLETE TRAINING SERVICE IN MANY SUBJECTS

You who have not completed high school or have missed vocational training in college, and who cannot spare time to go away to school, can complete your education in your choice of many subjects. Several of these are listed in the coupon at right. Check the subject in which you are interested, fill in your name and address, clip and mail the coupon today.

AMERICAN SCHOOL

Dept. G-845, Drexel at 58th Street, Chicago 37

PRACTICAL, EFFECTIVE HOME - STUDY TRAINING SINCE 1897

Take This First Easy Step

CHECK, CLIP AND MAIL COUPON NOW

AMERICAN SCHOOL, Dept. G-845, Drexel at 58th, Chicago 37, Ill.

Without obligation, Please send FREE and postpaid, bulletin and details of the Subjects checked.

- | | | |
|--|---|--|
| <input type="checkbox"/> PLASTICS ENG'R | <input type="checkbox"/> Accounting and C.P.A. | <input type="checkbox"/> Drafting and Design for Men and Women |
| <input type="checkbox"/> Refrigeration | <input type="checkbox"/> Cost Accounting for Manufacturing | <input type="checkbox"/> Radio |
| <input type="checkbox"/> Architecture and Building | <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> High School |
| <input type="checkbox"/> Practical Plumbing | <input type="checkbox"/> Private Secretary | <input type="checkbox"/> Air Conditioning |
| <input type="checkbox"/> Automotive Engineering | <input type="checkbox"/> Diesel Engineering | <input type="checkbox"/> Shipbuilding |
| <input type="checkbox"/> Aviation Drafting | <input type="checkbox"/> Surveying & Topographical Drafting | <input type="checkbox"/> Mechanical Eng. |
| <input type="checkbox"/> Aviation | <input type="checkbox"/> Sheet Metal | <input type="checkbox"/> Shop Management |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Pattern Drafting | <input type="checkbox"/> Tool Making |
| | <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Better Foremanship |
| | | <input type="checkbox"/> Machine Shop Operations |

Name..... Occupation.....

Address..... Age.....

City..... State.....



Know Electricity as Experts Know It—and Get an Expert's Pay!

What about your future? Who is safe today? Surely not the man who is contented to stand still! Know your job thoroughly—prepare yourself for jobs ahead. To do just this thousands of men have used

The Croft Library of Practical Electricity

The Croft Library is a complete electrical educator. It is founded on practice—on 20 years of shirt-sleeve experience—on work as it is actually done. It is jammed from cover to cover with the kind of hard-headed facts you want. Written so that the beginner can easily understand it, yet so sound, so thorough, that it is the daily guide of 30,000 highly paid electrical workers and engineers. Croft tells you the things you need to know about motors, generators, armatures, commutators, transformers, circuits, switchboards, distribution systems—electrical machinery of every type—wiring for light and power—wiring of finished buildings—underwriters and municipal requirements—illumination in its every phase—the most improved methods of lighting—lamps and lamp effects, etc.—how to do a complete job, from planning it, to completion.

No money down—easy payments

Fill in and mail the coupon attached and we will send you the entire set of seven volumes for ten days' examination on approval. We take all the risk—you assume no obligation. If you decide to keep the books, send \$3.00 in ten days and the balance at the rate of \$1.00 a month. Send the coupon to G.W. and see the books for yourself.

EXAMINATION COUPON

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. 18

Send me for ten days' examination on approval the Croft Library of Practical Electricity, 7 vols. If satisfactory I will send you \$3.00 in 10 days and \$3.00 monthly until the price of \$18.00 is paid. If not wanted, I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

Name.....

Home Address.....

City and State.....

Position.....

Name of Company.....PM-11-43

Listen to this Record!

SPEAK SPANISH FRENCH, GERMAN, OR ITALIAN

Big opportunities awaiting Americans who speak Spanish. Learn as easily as a child learns—"by listening" to these brand-new CORTINA recordings.

Only 15 Minutes a Day

THOUSANDS have found it the most fascinating, most satisfactory method. Here is the quick, easy way to learn Spanish for PLEASURE AND BUSINESS. INVESTIGATE!

Sent on 5 Days' Approval



"The Cortina Short-Cut" tells just what you want to know. Interesting. Get it.

Write Today—NOW!

CORTINA Academy (Language Specialists for 60 Years)
Dept. 6411, 105 West 40th Street, New York 18, N. Y.

Please send me free—without obligation—your booklet, "The Cortina Short-Cut." I am interested in (mark):

☐ SPANISH ☐ French ☐ Italian ☐ German

Name

Address

Mechanically Inclined Men HOME APPLIANCE REPAIRING Offers Big Money-Independence

America's War Made Industry

Restriction of manufacturing has meant that the men who know Home Appliance Repairing—fixing refrigerators, vacuum cleaners, washing machines, motors, welding, nickel plating, etc., etc., are reaping a steady, daily stream of dollars and building for themselves a permanent profitable business.

No Previous Experience Needed

The ability to hold and use a tool plus an ambition to make money is all that you need to become a successful Repair Shop Owner.

Full Time or Spare Time

Work as many hours as you want. \$5.00—\$6.00 an hour often made.

New Course Tells All

Our new course on Home Appliance Repairing... profusely illustrated shows you in simple, easy to understand language how to make all repairs, build tools you need and how to get business to come to you. Price of course is so low that your savings on your own household repairs will quickly pay for it. Send today for complete FREE literature on how you too can get started.

CHRISTY SUPPLY CO.,

2835 N. Central Ave.,

Dept. D-303, Chicago

Inventions Wanted Patented or Unpatented

Inventions can now be safely sold without patenting expense. If you have a practical, useful idea for sale, either unpatented or patented, write Chartered Institute of American Inventors
Dept. 4, 631 Pa. Ave., N. W. Washington, D. C.

INTRODUCING-New Victory Model HANDIWELD ELECTRIC

ARC WELDER

FULLY
GUARANTEED

RETAILS
ONLY
\$1.95



PLUGS INTO LIGHT SOCKET

Victory Model Handiweld Arc Welder operates from 110 volts, A.C. or D.C. current same as other arc welders higher priced; generates tremendous heat to weld all metals. Not a toy welder that uses carbons, but actually uses standard coated rods—sizes 1/16" and 3/32". However, due to Priorities a generous supply of 1/16" rods only are supplied with the welder. Guaranteed not to burn out. Repairs fenders, auto bodies, radiators, machinery, cars, etc. Take Victory Model Handiweld anywhere to job, operate right from light socket. You'll find a thousand uses for this welder around your home, garage, workshop. Also in garages, factories, repair shops, tin shops, mechanics, inventors, farmers, etc. Model "Handiweld" now.

Order a "Victory Model" Handiweld now. **SEND NO MONEY** We'll rush one to you with rods, helmet, operating instructions, and all necessary parts with the exception of a large jar and a small piece of extension cord; these most everyone has. Pay postman only \$1.95 plus a few cents postage. If not delighted return Victory Model Handiweld in 5 days from receipt and money paid for it will be refunded promptly. Rush your order now, **KUMFY PRODUCTS INC., Dept. W-202, Cincinnati, Ohio**

Say you saw it in Popular Mechanics!

RICH REWARDS FOR THOSE WHO KNOW PLASTICS

BE A PLASTICS TECHNICIAN

Do you want action *now*—in a vital, growing war-time industry . . . helping to turn out fighting planes and jeeps and bombs and tanks? There's a big demand for men and women plastics technicians to fill important war industry positions . . . and if you start your training now—at home—you may qualify for a place in this vital part of the war program.

LOOK TO THE FUTURE

Even more important is the question—what will you do when the war is over? Will you be among those fighting for jobs that may no longer exist? Or will you be well on your way to a permanently profitable career, or established in your own business, with plastics?

Build your personal post-war plans on a sound knowledge of plastics. This country is already in the Plastics Era. The future of the plastics industry is so rich that some predictions seem exaggerated and fantastic . . . but the fact remains that plastics have proven themselves and are vital in the production of airplanes, autos, furniture, radios, trains, clothing, electrical appliances and equipment, machinery, tools, and hundreds of other products.

CHOOSE YOUR FIELD...Enter it thru PLASTICS

You should be able to see for yourself what plastics will mean in virtually every field—the possibilities that will be available to those trained in plastics. Now is the time to prepare for your chosen field, as a plastics technician.

LEARN AT HOME

Make your increased hours at home pay you dividends. You can easily fit into your spare time your training for a career in plastics. You won't need to lose one minute from your present work . . . simply devote a few hours each week to enjoyable home study, like thousands of other men and women are doing who are helping their country while helping themselves. The Plastics Institute course is an easy, practical tested method which will help fit you for this promising and interesting field . . . and if you are now working with plastics, it equips you for advancement. During the entire course your training is supervised by men well known in the plastics industry, in which they have been recognized as authorities for years.

TIME IS PRICELESS—ACT NOW!

Find out how the Plastics Institute can help YOU. Mail the coupon for your copy of the large FREE, illustrated booklet, the "World of Plastics." It is crammed with valuable information about plastics, tells about the new plastic airplanes and other uses for this revolutionary new material . . . as well as about the opportunities for YOU in plastics. Decide NOW to let plastics point the way to YOUR success . . . send the coupon TODAY.

STUDENTS REPORT SUCCESS

"I wish to acknowledge, with thanks, the receipt of my final examination papers, my certificate of graduation, and the lesson binders you sent me.

"I have really enjoyed your excellent course of study, and the friendly help and cooperation you have given me, and feel that the time and money expended on my training has been well worthwhile."

R.F.P.

Plastics

INDUSTRIES TECHNICAL INSTITUTE

1221 Chanin Bldg.
New York

626-E LaSalle-Wacker Bldg.
Chicago

190 So. Alvarado St.
Los Angeles

AMERICA'S ORIGINAL
PLASTICS SCHOOLS

MAIL COUPON FOR FREE BOOK

Plastics Industries Technical Institute
626-E La Salle-Wacker Bldg., Chicago

Gentlemen: Please send me the booklet "World of Plastics" and information on your training program. I understand there is absolutely no obligation.

Name _____ Age _____

Street _____

City _____ State _____

Dept. 11

GET THIS
INTERESTING
BOOK
"WORLD OF
PLASTICS"
SENT FREE



GET FULL DETAILS NOW

BIGGER PAY for ELECTRICAL & RADIO Trouble Shooters!

GET THIS SENSATIONAL NEW
TROUBLE-SHOOTING MANUAL
ELECTRICIANS! RADIO MEN!
Beginners, old timers! This new
COYNE Trouble Shooting Manual
saves time, avoids errors. Helps you
do better work, make more money.
Examine 5 days FREE—mail coupon.

4 BOOKS IN ONE!

Big 8 1/2 x 11" volume contains:
• 500 Shop Prints, Wiring
Diagrams on Motors, Ra-
dios, Electronics, etc. • New
"Step-by-Step" Trouble
Shooting Course. • Electr-
ical - Radio Dictionary. •
Spare Time Work Lessons.

FREE! 1 Yr. Technical
Service by mail from
Coyne Staff, on your
trouble-shooting
problems.

SEND NO MONEY!

See amazing offer below.
You need this practical
book NOW. Act!

5 DAY
FREE
TRIAL



H. C. LEWIS, Pres. Dept. 83-3
COYNE ELECTRICAL SCHOOL
500 S. Paulina St., Chicago 12, Illinois
Send postpaid, new COYNE Electrical & Radio Trouble
Shooting Manual. Within 5 days after receiving, I'll either
return it or send \$1.95 and then \$3 monthly until total of \$7.95
is paid. () Cash price \$7.15—YOU SAVE 10%. Same 5-day
free trial and return privilege.

NAME _____
ADDRESS _____
CITY _____ STATE _____

Learn this Profitable Profession



in 90 Days at Home

Hundreds of men and women of all ages 18-50 make \$10.00 to
\$20.00 in a single day giving scientific Swedish Massage and
Hydro-Therapy treatments. There is a big demand from
Hospitals, Sanitariums, Clubs, Doctors and private patients as
well as opportunities for establishing your own office.

Learn this interesting money-making profession in your own home
by mail, through our home study course. Same instructors
as in our NATIONALLY KNOWN resident school. A diploma
is awarded upon completion of the course. Course can be com-
pleted in 3 to 4 months. High School training is
not necessary. Many earn big money while learn-
ing. The Army and Navy need hundreds of men
and women trained in Massage and Physiotherapy.

Anatomy Charts & Booklet FREE

Enroll now and we will include uniform coat,
medical dictionary, patented reducing roller and
Hydro-Therapy supplies without extra cost. The
reducing course alone may be worth many times
the modest tuition fee.

Send coupon now for Anatomy Charts and booklet
of photographs and letters from successful grad-
uates. These will all be sent postpaid—FREE.

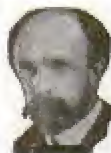


THE College of Swedish Massage
Dept. 864—100 E. Ohio St., Chicago 11
You may send me FREE and postpaid, Anatomy Charts, booklet
containing photographs and letters from graduates, and complete
details of your offer.

Name _____
Address _____
City _____ State _____

Do You Make Mistakes in English?

EVERY time you speak or write you show just what you are. Mis-
takes in English reveal you as a person who lacks education and
refinement. Lack of language power prevents you
from presenting your thoughts in the strongest possi-
ble way. No matter what you do, real command of
English will help you to your goal. Stop making
mistakes in spelling, punctuation, pronunciation. In-
crease your vocabulary.

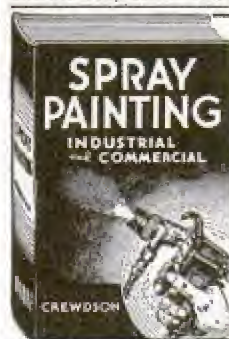


WONDERFUL INVENTION

Only 15 minutes a day with Sherwin Cody's new in-
vention—and you can actually SEE your English im-
prove. It teaches by HABIT—makes it easier to do the
RIGHT way. Wonderful self-correcting lessons include
spelling, punctuation, grammar and expression.

FREE BOOK ON ENGLISH Lack of language
power may easily be
costing you thousands of dollars every year. See what
Mr. Cody can do for you; it costs nothing to find out. Mail a postal
card or letter this very minute for free book, "How You Can Master
Good English in 15 Minutes a Day". It will prove a revelation to
you. WRITE NOW. Address:

Sherwin Cody School of English, 511 Searle Bldg., Rochester 4, N. Y.



OPERATORS NEEDED Make Big Money—Learn At Home

This book gives you detailed instruc-
tions for industrial and commercial
spray painting, essential to war pro-
duction. Full information on pig-
ments, thinners, varnishes, tech-
niques, spray guns of all types, fancy
finishes, with a special section on
WALL work. Easy to understand.
Cloth bound—125 pages—fully illus.
Only \$1.50. Postage prepaid if cash
in advance.

ORDER TODAY

FRED K. DRAKE & CO.

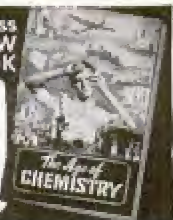
Dept. PM11, 600 W. Van Buren St., Chicago, Ill.

IT'S FREE Don't Miss This NEW BOOK

"The Age of Chemistry"

New 1943 Chemcraft Chemistry Book de-
scribes many amazing experiments you can
perform; and tells of the big opportunities,
both now and in the future, for boys with
a knowledge of chemistry... Send Today.

THE PORTER CHEMICAL COMPANY
45 Prospect Ave. Hagerstown, Md.



JOKE BOOKS For Adults

The kind they like. You will be both a Riot
and the Life of the Party with a set of these
pocket size joke books. They are full of En-
tertainment, Fun and Humor. A set of six
books only 50c or a special assortment of
12 books all different for \$1.00. Print name
and address, send cash or stamps to:

TREASURE NOVELTY CO.

72—5th Ave. Dept. 1211. N. Y. 11, N. Y.

JIU JITSU 3 LESSONS 10¢

Investigate the course experts buy. Authentic, com-
plete. Send 10c today for 3 trial lessons, full details.
MODERN SCHOOL OF JIU JITSU, Dept.-M, 5 W. 52 St., N. Y. 19.

MAKE MONEY AT HOME!

Learn to color photos and miniatures
in all. No previous experience needed. Good
demand. Send for free booklet, "Make
Money at Home" and requirements.

NATIONAL ART SCHOOL

1315 Michigan Ave. Dept. 1358 Chicago

MONEY IN RABBITS—CAVIES

WE BUY and put you in touch with other markets.
Catalog and copy of magazine 10c. Or send
25c for Book Catalog and Price List and 3 mo.'s subscrip-
tion to the AMERICAN SMALL STOCK FARMER.
OUTDOOR ENTERPRISE CO., BV 54, PEARL RIVER, N. Y.

FIBRE ARMS AND LEGS!
Light, correctly fitted, strong and com-
fortable. Natural appearance.
Braces for all deformities.
Scientific design. Fair Terms.
BUCHSTEIN-MEDCALF 610-3rd Av. S., Minneapolis, Minn.



COMPLETE
READY
TO USE



PACKED WITH 1,000 PICTURES

This sensational volume is easy to read, thrilling to follow, simple to understand. Photographs explain the text, picture - diagrams illustrate the stories, and pictorial life-stories simplify the exciting information. There are dozens of absorbing chapters on thousands of animals, plants and human life. Hundreds and hundreds of pictures of every kind and size, and even wonderful panoramic pictures

OVER A FOOT WIDE. Learn nature and science the quick, new, easy, picture-story way. Your friends will soon be astonished by your immense knowledge. Everyone will admire you.

BIG FREE OFFER

EXAMINE IT FREE

If you send for the big **WONDERS OF LIVING THINGS** immediately, you will receive **FREE** with your order the 150-power microscope pictured above together with glass slides and directions. You will be overwhelmingly delighted, but if you're not you may return them for full refund within five days. **THIS BIG FREE OFFER IS LIMITED** to the supply of microscopes available to us. Due to war conditions, we cannot guarantee this very long. To avoid disappointment, **ACT WHILE THE SUPPLY LASTS.** Send no money. **RUSH COUPON TODAY.**

METRO PUBLICATIONS
50 West 17th St., New York 11, N. Y.



FREE 150 POWER MICROSCOPE

with this offer

Here's a fine, complete microscope for you **FREE**. This superior instrument magnifies 150 times, and is all ready to use at once. Substantially made, this wonderful microscope rests in a large base, has a tilted stand, with adjustable mirror. It has powerful lenses, with focusing adjustment. This lifetime microscope also comes to you with glass slides and directions. These features make microscopy as simple as ABC and as exciting as possible . . . There is nothing to put together, and nothing to assemble. It is completely equipped. Everything packed in a neat, sturdy corrugated container. This marvelous microscope reveals to your fascinated eyes thousands of nature's hidden secrets and wonders of living things—insects, microbes,

foods, minerals, etc.—beautiful, monstrous, strange and bewildering . . . Study these thousands of objects by turning on them this 150-power microscope—perform simple and startling experiments on them, and become the envy of your friends.

This whole outfit made in U. S. A.—complete microscope, slides and directions—are yours **ABSOLUTELY FREE . . .** while the supply lasts . . . by quickly accepting our amazing offer on the big, miracle-book of science and nature, **WONDERS OF LIVING THINGS.**

THE MIRACLE WORLD OF ALL LIFE

When you open this big **MIRACLE BOOK** full of exciting pictures, you enter at once into the adventurous world of living nature. Here are **MARVELS** of human life, **MYSTERIES** of plant life, **WONDERS** of animal life. Here are strange beasts from the polar regions, fascinating fish from the bottom of the sea, amazing birds from distant skies, and curious animals from the jungles of Asia and Africa. Here are **HUNDREDS OF THRILLING STORIES** about them, all true, all instructive and all in **BIG, PICTURE-CROWDED PAGES.**

THRILLING MYSTERIES OF LIVING WONDERS

Call the roll of the most fascinating creatures in the world. Look at them in thrilling pictures. Read about them in entertaining stories. Tree-climbing crabs that steal coconuts. Terrifying worms that chase men and animals. Dragons of Komodo who eat through metal. Innocent-looking flowers that trap insects and eat them. Fish that catch flies for food by spitting up at them out of the water. Small killer whales that slaughter huge whales 100 times their size. These are just a few of the mysterious creatures that you look at and read about. Just a few of the thousands of reading thrills which crowd the **LARGE, PICTURE - PACKED** pages of this miracle-book of science and nature.

**RUSH
COUPON
NOW**

SEND NO MONEY

METRO PUBLICATIONS, Dept. 223-N
50 West 17th Street, New York 11, N. Y.

Send me a copy of **WONDERS OF LIVING THINGS . . .** also include my complete 150-power microscope outfit with this order. I will pay postman \$1.98 plus postage on arrival. If I am not satisfied I may return them within five days for full refund.

NAME.....

ADDRESS.....

☐ Check here if you are enclosing \$1.98, thus saving mailing costs (same guarantee).
Canadian orders \$2.50 in advance.



CAN YOU FIX IT?

These wonder books tell step by step HOW to take out "play" in differential—to kill the shimmy in steering—to set TIMING—how to put your finger on engine trouble and the expert way to FIX it.

6 BIG VOLUMES

2500 pages, 2000 illustrations, wiring diagrams, etc., including Marine Engines, Aviation Motors, Diesel engines, etc. De Luxe edition, gold-stamped flexible binding.

AMERICAN TECHNICAL SOCIETY, Vocational Publishers since 1899
Drexel Ave. & 58th St., Dept. A813, Chicago 37, Ill.

I would like to see the 6-volume edition of your AUTO BOOKS. I will pay the delivery charges only, but if I choose to, I may return them express collect. If after 10 days use I prefer to keep them, I will send you \$1 and pay the balance at the rate of only a month, until \$24.95 is paid. Please include consulting service and extra Volume No. 7, as per your offer above.

Name
Address

City State
Please attach letter stating age, occupation and name and address of employer and that of at least one business man as reference. Men in service, also please give home address.

AUDELS Carpenters and Builders Guides 4 vols. \$6



Inside Trade Information for Carpenters, Builders, Joiners, Building Mechanics and all Woodworkers. These Guides give you the short-cut instructions that you need—including new methods, ideas, solutions, plans, systems and money saving suggestions. An easy progressive course for the apprentice and student. A practical daily helper and Quick Reference for the master worker. Carpenters everywhere are using these Guides as a Helping Hand to Easier Work, Better Work and Better Pay. To get this assistance for yourself, simply fill in and mail the FREE COUPON below.

Inside Trade Information On:

How to use the steel square—How to file and set saws—How to build furniture—How to use a mitre box—How to use the chalk line—How to use rules and scales—How to make joints—Carpenter arithmetic—Solving mensuration problems—Estimating strength of timbers—How to set girders and sills—How to frame houses and roofs—How to estimate costs—How to build houses, barns, garages, bungalows, etc.—How to read and draw plans—Drawing up specifications—How to excavate—How to use settings 12, 13 and 17 on the steel square—How to build hoists and scaffolds—skylights—How to build stairs—How to put on interior trim—How to hang doors—How to lay floor—How to paint



THEO. AUDEL & CO., 45 W. 23rd St., New York City

Mail Audels Carpenters and Builders Guides, 4 vols., on 7 days' free trial. If O.K. I will remit \$1 in 7 days, and \$1 monthly until \$6 is paid. Otherwise I will return them. No obligation unless I am satisfied.

Name

Address

Occupation

Reference P.M.

Say you saw it in Popular Mechanics!

AUTO BOOKS SENT FREE

on approval. Just mail the coupon and we'll send you a set of these remarkable auto books. Whether you are a mechanic or helper, expert or apprentice, auto owner or driver, if you're interested in knowing all about automobile mechanics, take advantage of this FREE EXAMINATION OFFER.

GET A BETTER JOB

A better job—in the gigantic auto industry. BIGGER PAY—a chance to go into business for yourself and get a share of the profits, are waiting for any man who even half tries to improve himself. Learn auto engineering with these wonder books a new way—a quick reference method. Simply use the JIFFY INDEX to look up the answer to any auto problem. Built by eleven of America's great automobile engineers, and written in simple language so you can understand it.

[A year's consulting privileges with our engineers now given with these books without extra charge.]

For a short time we will include a New EXTRA volume with over 300 pages including late cars with wiring diagrams and data sheets on each.



LEARN TO DRAW CARTOONS BIG MONEY EASY, PLEASANT WORK!

Let CHAS. H. KUHN with 25 years actual experience in drawing a daily newspaper cartoon, teach you how to Create, draw and sell your work. 52 complete lessons—one sent each week. Start on the road to fame and fortune now—Write Today!

Complete Course Only \$7.50

KUHN SCHOOL OF CARTOONING
420 Murphy Building Indianapolis 4, Indiana

ARTIFICIAL ARMS-LEGS

WRITE FOR FREE BOOK showing how armless mechanics, office workers, farmers, carpenters, laborers hold regular jobs; how they feed, shave, dress themselves, pick up large and small objects, carry grips, etc. with the WORLD RENOWNED CARNES ARTIFICIAL ARM. Rehabilitation by CARNES LEGS too. BOOK SENT FREE—advise whether interested in leg or arm—no obligation, send for it now.

CARNES ARTIFICIAL LIMB CORP.

Dealers and Representatives Everywhere

908-M East 12th

Kansas City, Mo.

Become a Doctor of PSYCHOLOGY

Win the degree of Ph.D. Teach the secret of contentment, happiness. Solve mental worries. Experience the revelation of truth. Chartered college. Individual help. Write for FREE book. COLLEGE OF UNIVERSAL TRUTH, 5631-B North Ashland Ave., Chicago.

LEARN MACHINIST TRADE TOOL & DIE MAKING

In completely equipped Shops. Also short special Shop courses for essential War jobs. Learn on actual Shop work. For FREE BOOK, write Dep't PM-11.

ALLIED SCREW MACHINE CO. (School Div.) 609 W. Lake, Chicago, Ill.

MENTAL SCIENCE

Awaken Your Hidden Powers!

You are a sleeping giant... learn how to release your unused forces. New ready-practical reading-course in everyday psychology. Teaches you self-mastery, influencing others, getting ahead, etc. Written by 34 psychologists. Low price. Satisfaction guaranteed. FREE DETAILS, write today! Nelson Co., 321 S. Wabash, Dept. 602, Chicago.

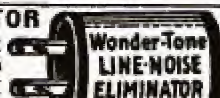
YOUR OPPORTUNITY!

TECHNICAL BOOKS of All Publishers for Free Examination. Write today for Free copies of catalogues. MODERN TECHNICAL BOOK CO., 55 West 42 St., New York 18, N. Y.

Wonder-Tone NOISE ELIMINATOR

Just attach to your radio (long, short wave) and enjoy reception free from distracting noises. Send No-Money Pay Postman 60c plus postage or send \$6.00 and we'll send postpaid. Return in 5 days for refund if not delighted.

WONDER-TONE COMPANY, Dept. 34, 3078 N. Clark St., Chicago, Ill.



TOMBSTONES \$10.95 UP FREIGHT PAID

High Quality Granite and Marble. Lettered. Guaranteed. Write for Free Catalog and samples of stone. Without Delay. Order By Mail. U. S. MARBLE & GRANITE CO., A-18, ONECO, FLA.

PEPSI-COLA HITS THE SPOT



GENUINE U.S. BARGAINS

O. D. WOOL BLANKETS (USED) . . . \$2.95
MCCLELLAN SADDLES (USED) . . . 5.95
U. S. ARMY PUP TENTS (USED) . . . 3.50
Slightly Used Army Caisson Wheels with Axles, 56" high, weight per pair with Axle, 322 lbs. \$37.50

Thousands of Other Bargains in Military, Outdoor & Sport Goods for Hunter, Farmer, Scout Send 10c for 32-page catalog returned with first order.

A and N SUPPLY CO.,
4720 LESTER ST. RICHMOND, VA.

New!

COYNE "Learn-by-Doing" Shop Course RADIO Communications and ELECTRONICS



AIRCRAFT RADIO



BROADCASTING



ELECTRONICS

MEN!
whether you're
16 OR UP TO 50
TRAIN AT COYNE
ON REAL RADIO
EQUIPMENT!



GET READY NOW FOR A GREAT VICTORY FUTURE

I'll Finance Your Training



TALKING PICTURES



POLICE RADIO



TELEVISION



RADIO RECEIVERS

War has created tremendous opportunities for men in RADIO OPERATING AND ELECTRONICS. Here is the practical "Learn-by-Doing" shop training in this big field. Not by correspondence, but actual experience on real Radio and Electronic apparatus.

START NOW—PAY LATER!

I make it easy for you to come to Chicago for my practical training. Don't let lack of money hold you back! You can pay tuition **AFTER YOU GRADUATE**. I'll even help you secure **part-time work** while at Coyne to help pay living expenses. My plan has aided thousands—**coupon brings complete details**.

Prepares for Gov't License

Many of the better Radio jobs require U. S. Govt. license. Coyne has prepared hundreds of men for this test. Our graduates hold good positions in broadcast stations, air transport, police radio and motion picture studios.



You'll Receive Personal Instructions on Fascinating Radio and Electronic Apparatus

It's the thrill of a lifetime when you first operate the amazing variety of up-to-the-minute Radio and Electronic equipment at Coyne! Experts show you each step, train you thoroughly. You'll learn to send Code rapidly—do actual trouble-shooting on Television, short-wave and electronic devices. With this training you get my **LIFETIME EMPLOYMENT SERVICE**. I train you for a real job, then help you get it!

H. C. LEWIS, President

COYNE ELECTRICAL SCHOOL RADIO DIVISION

500 S. Paulina Street, Dept. 83-3H Chicago, Ill.

SEND FOR MY FREE BOOK!

Find out all about the sensational new future for Coyne-trained Radio Operators and Industrial Electronic Specialists. My **FREE BOOK** is full of photos and job information. There's a place in this vast field for YOU. Age, lack of experience bars no one. Coyne has been training men 44 years—is nationally famous. Act now. Use handy coupon. No obligation; no salesman will call. Don't delay. Send it today!

See How Easily YOU can get my Radio Shop Training!

MAIL COUPON



H. C. LEWIS, Pres.,
RADIO DIVISION
COYNE ELECTRICAL SCHOOL, Dept. 83-3H
500 South Paulina St., Chicago, Ill.

Without obligating me, send your **FREE BOOK**, "Your Future in RADIO", and tell me about your "Pay-After-Graduation" plan.

NAME.....
ADDRESS.....
CITY.....STATE.....

Be Popular—Learn
the **Newest DANCES**
in 5 DAYS—or NO COST!

NEW REVISED EDITION of DANCING

includes the Rhumba, Congo,
Samba, Jitterbug . . . Fox
Trot, Waltz and Tap Dancing.

All the newest Swing steps—the Rhumba, Congo, Samba, Jitterbug, as well as the Fox Trot, Waltz and basic tap steps—explained with simple, graphic diagrams. **GET MORE FUN OUT OF LIFE!** Swing your way to popularity! Start now and fill your future with Romance! **MAKE THIS FREE TEST!** The new REVISED edition of Betty Lee's book, Dancing, helps you learn correctly and quickly. Be convinced—if not satisfied with results, you will get your money back! And remember, we include two other books—"Tip Top Tapping" and "Swing Steps"—FREE of extra charge. **SEND NO MONEY!** Pay the postman \$1.98 plus a few cents postage. Follow instructions in ALL THREE BOOKS—practice simple dance steps each day and in 5 days if you haven't learned to dance, we will refund your money!



PIONEER PUBLICATIONS, INC.
1790 Broadway, Dept. 9411H
New York 19, N. Y.
Send me "Dancing," by Betty Lee, and
include 2 free books.
☐ Ship C.O.D. I will pay on arrival,
plus postage.
☐ I enclose \$1.98. Ship postage prepaid.
If in 5 days I do not learn to dance, I may
return book and you will refund purchase price.
Name.....
Address.....
City..... State.....

9 BIG BUILDING BOOKS



SHIPPED
**FREE FOR
EXAMINATION**

Learn to draw plans, estimate, be a live-wire builder, do remodeling, take contracting jobs. These 9 practical, profusely illustrated books cover subjects that will help you to get more work and make more money. Architectural design and drawing, estimating, steel square, roof framing, construction, painting and decorating, heating, air-conditioning, concrete forms and many other subjects are included.

BETTER JOBS—BETTER PAY

Keep busy now at good pay, and be prepared for after-war building boom. Big opportunities are always for MEN WHO KNOW HOW. These books supply quick, easily understood training and handy, permanent reference information that helps solve building problems.

UP-TO-DATE EDITION

These books are the most up-to-date and complete we have ever published on these many subjects.

Coupon Brings Nine Books FREE For Examination

AMERICAN TECHNICAL SOCIETY Vocational Publishers since 1895
Dept. 6819 Drexel at 58th Street. Chicago 37, Ill.

You may skip me the Up-to-Date edition of your nine big books, "Building, Estimating, and Contracting" without any obligation to buy. I will pay the delivery charges only, and if fully satisfied in ten days, I will send you \$2.00, and after that only \$3.00 a month, until the total price of only \$29.50 is paid. I am not obligated in any way unless I keep the books.

Name.....
Address.....
City..... State.....
Please attach a letter stating your age, occupation, employer's name and address, and that of at least one business man as a reference. Men in service, also please give home address.

MAGIC PHOTO LIQUID

Prints Pictures on—
CLOTH LEATHER PAPER WOOD



Amazing discovery permits you to print pictures from any of your snapshot negatives on wood, cloth, leather or paper. Like magic, your pictures will show on tiles, handkerchiefs, purses, cards, letterheads. Takes only few minutes in broad daylight. Won't rub off or harm negative.

NATURAL COLORS TOO! Imagine having your favorite snapshots—your sweetheart's, baby's or your own, shown in natural colors—in artistic shapes and designs on whatever material used.

SEND NO MONEY! Just rush your name and address for introductory outfit. Enough material to print and color 100 average size pictures, only \$1.00. But don't send a penny. Pay the postman when it arrives—plus a few cents postage. You risk nothing. It's guaranteed to work. Send today. (Canada \$1.25 M.O. only.)

L & M MFG. Co., Dept. 271, Neave Bldg., Cincinnati 2, Ohio

STUDY ENGINEERING AT HOME

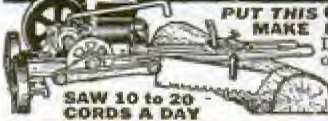
With A Chartered Educational Institution

Courses in ENGINEERING: Electrical, Civil, Mechanical, Drafting, Architectural, Steam, Aeronautical, Radio, Structural, Mining, Industrial, Highway, Petroleum, Marine, Chemical.

Courses in ARTS AND SCIENCES: Philosophy; Education; Letters; Public Health; Medical Jurisprudence; Psychology; Sociology; Physics; Chemistry; Geology; Pol. Science; Theology; Law; Business and Commerce; Accounting; Mathematics; Statistics; Agriculture.

McKinley-Roosevelt Incorporated, 4610-TC, Sheridan Road, Chicago, 40

OTTAWA LOG SAW Write for FREE BOOK

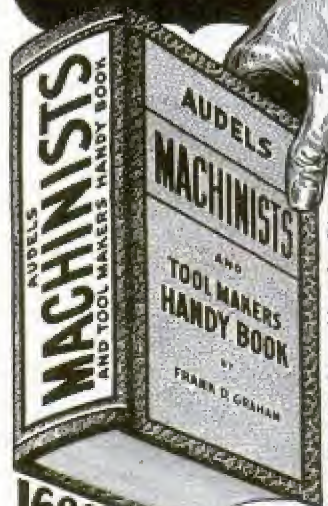


PUT THIS OTTAWA to work for you. MAKE MONEY! Wood is valuable. Does more than 10 men. Easily operated. Falls trees—and saws limbs. Use 6-hp. engine for other work.

SAW 10 to 20
CORDS A DAY

OTTAWA MFG. CO.
1127 Wood St. Ottawa, Kans.

AUDELS NEW MACHINISTS HANDYBOOK NOW READY!



Prepare!

A KEY TO SHOP PRACTICE
For Every Machinist, Tool-maker, Machine Operator, Draughtsman, Metal Worker, Mechanic or Student. Covers Shop Practice in All Branches.

A READY REFERENCE
Tells How to Operate and Set Up Lathes, Screw and Milling Machines, Shapers, Drill Presses and All Machine Tools.

5 PRACTICAL BOOKS IN ONE!
60 FULLY ILLUSTRATED CHAPTERS
Covering: 1—Modern Machine Shop Practice. 2—Blue Print Reading and How to Draw. 3—Calculations & Mathematics for Machinists. 4—Shop Physics. 5—How to Use Slide Rule.

Get This Information for Yourself. Mail Coupon Today. No Obligation Unless Satisfied, ASK TO SEE IT.

1600 PAGES FULLY ILLUSTRATED \$4 COMPLETE • PAY ONLY \$1 MO.

THEO. AUDEL & CO., 49 WEST 23rd STREET, NEW YORK
Mail AUDELS MACHINISTS & TOOLMAKERS HANDY BOOK. Price \$4 no 7 Days Free Trial. If O. K. I will remit \$1 in 7 days and \$1 monthly until \$4 is paid. Otherwise I will return it.

Name.....
Address.....
Occupation.....
Reference..... P. M.

Now YOU Can Lick Any AUTO REPAIR JOB!

IN LESS TIME—WITH LESS WORK



**FREE
7-DAY OFFER**



MoToR's New Auto REPAIR MANUAL
shows you how to service and
repair ANY part of ANY car!

No auto repair job is too tough when you've got MoToR's AUTO REPAIR MANUAL! YOU can repair anything from carburetor to rear end—quickly, easily, right! Just look up make, model, and the job in the quick index—and go to work! Clear, illustrated instructions lead you step by step.

To make such an amazing book possible, the engineer-editors of MoToR Magazine collected and "broke down" 150 official factory shop manuals for you, spotted all the vital repair information you need, dove-tailed it all together in to ONE handy, easy-to-understand book.

No Other Manual Like It!

This BIG book—over 600 pages, 8½ x 11 inches, bound in sturdy fabrikoid—brings you nearly 200,000 service, repair, adjustment, replacement, tune-up facts on every car built from 1935 to 1942. More than 1000 cut-away photos, dia-

grams, drawings show you exactly WHAT to do and HOW to do it! Used by the U. S. Army, trade and technical schools everywhere, thousands of auto servicemen.

Now YOU—without cost—can see for yourself what a wonderbook MoToR's Auto Repair Manual really is. TRY it—FREE for 7 days! Learn first-hand how it can pay for itself the first few times you use it.

SEND NO MONEY 7-Day Free Examination

Just mail coupon below—without money! When the postman brings your book, pay him nothing. First make it show you what it's got! Unless you agree this is the greatest time-saver and work-saver you've ever seen—return book in 7 days and pay nothing. Mail coupon today! Address: MoToR Book Department, Desk X111, 572 Madison Ave., New York 22, New York.

USED BY
U. S.
ARMY

Clear, Pictured Facts on Every Job on Every Car Built Since 1935!

Nearly 200,000 service and repair facts on all these makes:

American	Ford	Oldsmobile
Bantam	Graham	Overland
Auburn	Hudson	Packard
Austin	Hupmobile	Pierce
Buick	Lafayette	Arrow
Cadillac	La Salle	Plymouth
Chevrolet	Lincoln	Pontiac
Chrysler	Lincoln	Reo
Cord	Zephyr	Studebaker
De Soto	Mercury	Terraplane
Dodge	Nash	Willys

Over 600 pages; including 50 pages of carburetor text, charts, illustrations, covering all models. Over 450 charts, tables: Tune-up Chart; Valve Measurements; Compression Pressure; Torque Wrench Reading; Starting Motor; Engine Clearances; Generator; Clutch & Brake Specifications; Front End Measurements, etc.; Engines; Electric Fuel, Cooling, Lubricating Systems; Transmissions; Universals; Front Ends; Wheels; Rear Ends, etc.

Same FREE 7-Day Offer Applies on New MoToR'S TRUCK REPAIR MANUAL

For mechanics, truck specialists, service stations, fleet owners. Covers EVERY job on EVERY truck made since 1930! 1400 pictures, 900 pages, 300,000 facts. Used by Armed Forces. Warranted to contain every essential fact you need to know. Fabrikoid binding, size 8½ x 11.

Covers all types Gasoline Engines; Diesels and Hesselmanns. Fuel Systems, Governors, Lubrication Systems, Ignition Systems, Starters, Generators, Clutches, Transmissions, Axles, Torque Dividers, Transfer Cases, Brakes, Steering, etc. etc.

Offered on same FREE 7-Day examination as Auto Repair Manual. Check box in coupon at right.



MoToR

Published by MoToR, The Leading Automotive Business Magazine. MoToR's manuals assure high standards of repair work.

MAIL COUPON NOW FOR 7-DAY FREE TRIAL

MoToR Book Dept., Desk X111, 572 Madison Ave., New York 22, N. Y. Rush to me at once: (check box opposite book you want).

- ☐ **MoToR's AUTO REPAIR MANUAL** (formerly "MoToR's Factory Shop Manual"). If O.K., I will remit \$1 in 7 days, and \$1 monthly for 4 months, plus 35c delivery charge with final payment (\$5.35 in all). Otherwise I will return book in 7 days. (Foreign price, remit \$7 cash with order).
- ☐ **MoToR's TRUCK REPAIR MANUAL**. (Described at left in the box.) If O.K., I will remit \$2 in 7 days, and \$2 monthly for 3 months, plus 35c delivery charges with final payment (\$8.35 in all). Otherwise I will return book in 7 days. (Foreign price, remit \$11 cash with order).

Name _____ Age _____

Address _____

City _____ State _____

☐ **SAVE 35c!** Check here if enclosing full payment (check or money-order) WITH coupon. We pay 35c shipping costs. Same 7-day return privilege.

Specialists Wanted

IN MANY BRANCHES OF AVIATION

Train in Miami!

This is the day of unequalled opportunity in aviation, IF you have the right kind of training. You can get such training in beautiful Miami and build a career in one of the world's fastest growing industries. Choose the branch of aviation in which you want to make your success. Embry-Riddle can train you for an important, big-pay job in that branch. Check, fill in and mail coupon AT ONCE for 24-page booklet of valuable information. Don't delay.

Embry Riddle
School of Aviation
 MIAMI 30, FLORIDA

Dean of Enrollments, Dept. 24: Please send me information about aviation training at Embry-Riddle.

- | | |
|--|--|
| <input type="checkbox"/> Instrument Technician | <input type="checkbox"/> Aircraft Mechanic |
| <input type="checkbox"/> Radio Communications | <input type="checkbox"/> Link Instructor |
| <input type="checkbox"/> Drafting and Design | |
| <input type="checkbox"/> Aircraft Engine Mechanic | |
| <input type="checkbox"/> Check here for details of ALL available courses | |

Name.....

Address.....



PATENTS

AND TRADE MARKS

C. A. SNOW & CO.

Registered Patent Attorneys Since 1875

Write for Free Book and "Certification of Invention" form

427 SNOW BUILDING, WASHINGTON 1, D. C.



LEARN MONEY-MAKING CARTOONING

IN SPARE TIME — by Easy Picture Chart Method

Same Simplified Method that has helped train creators of "Terry & Pirates," "Freckles," "Out Our Way," "Winnie Winkle," "Regular Fellers," "Strange As It Seems," "The Neighbors," and many others. Earn while learning. Send 10c for Picture Chart (to test your ability), and full details. (State age.)

THE LONDON SCHOOL, 4371 National Bldg., Cleveland 14, Ohio



To PROTECT Your INVENTION — Use this coupon, NOW

Delays are dangerous and may be very costly. My personal service assures prompt action, strict confidence, and a minimum of expense. I suggest that you send me a model or drawing, or sketch and description of your invention, and \$5.00. I will make a search and report

promptly as to its patentability and send you a copy of my 72-page booklet. Or, if you prefer to read my booklet first, mail the attached coupon at once. I will also send my "Record of Invention" form. (Over 40 years experience as a Registered Patent Attorney.)

L. F. Randolph, 302-D Columbian Bldg., Washington, D. C.

Please send me at once, free of charge, your 72 page booklet and "Record of Invention" form.

Name.....

Address.....

Fix Scratches, Dents, Nicks the Professional Way!



Get This Handy Kit!

Repair damaged furniture surfaces with new practical kit. Enables anyone to do fast, easy touch-up jobs like a professional cabinet finisher. Makes furniture and cabinets look new. Every home and shop needs this remarkable kit. Pays for itself over and over!

Amazing Results — Easy to Use

Kit includes 23 different items—scratch removers for slight scratches, assorted shades of shellac sticks for deep nicks, bottles of light and dark stains, shading lacquer, alcohol lamp with fuel, stainless steel spatula, touch-up brushes, scratch sticks, steel wool, sandpaper, rubbing liquid. Packed in handy leatherette finish case. Send for it today. Best investment of lifetime. Fully guaranteed. Detailed instructions supplied.

\$3.95

Postpaid

AMERICAN HOUSEHOLD BUREAU

Dept. F, 520 N. Michigan Ave., Chicago, Ill.

What Every Mason Wants

We have Masonic books and lodge supplies for Blue Lodge, Chapter, Commandery, Scottish Rite, and Shrine.

OUR RITUALS ARE USED THE WORLD OVER
 Send for free catalog of books and rituals for Masons, Odd Fellows, Knights of Pythias, Knights of Columbus, Elks, etc.
EZRA A. COOK, Publisher, P.O. Box 796, PH, Chicago 90, Ill.

★ ★ ★

FORTY POWER TOOLS

You Can Build at Low Cost

Now a NEW EDITION
 FEATURING TOOLS MADE OF WOOD

Power tools for your home workshop—at a cost anyone can afford. Make them yourself—lathes, drill presses, sanding machines, shaper, circular, band, and scroll saws and other power tools—from old auto, sewing machine, and other discarded parts that cost very little. Get the new edition, "Forty Power Tools You Can Make", and follow simple instructions, diagrams and photographs. Make yourself up to date, efficient machines that will do a good job for you and save you time, hard work, and many dollars. Send \$1.25 for "Forty Power Tools You Can Make" today or order on postal card and pay postman on delivery anywhere in U. S. A. Your money back if not satisfied.

POPULAR MECHANICS PRESS, Dept. 494, 200 E. Ontario St., Chicago

Say you saw it in
POPULAR MECHANICS

PATENTS Protect Your Idea! By securing FREE my "PROOF OF INVENTION" folder. *Exceptional Personal Service. Excellent References. Established 1906.*
E. E. VROOMAN, 871 Woodward Bldg., WASH., D. C.

PATENT YOUR IDEAS
 SEND FOR FREE BOOK

Written by Former Member Examining Corps (1923-24) U. S. Pat. Office.
CARL MILLER, Registered Patent Attorney
 Former Member Examining Corps U. S. Patent Office
 Woolworth Bldg., Dept. 113-A, New York — Bond Bldg., Dept. 113-A, Washington, D. C.

Let HOME MOVIES Help
You Learn

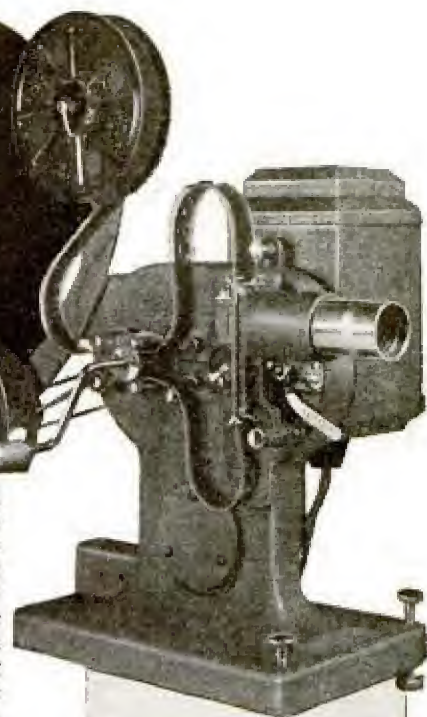
RADIO

ELECTRONICS . . . COMMUNICATIONS

Faster . . . Easier

DeForest's Training will prepare you quickly, thoroughly for a **GOOD PAYING WAR JOB** and an **INTERESTING PEACETIME FUTURE** in the great Billion Dollar **RADIO-ELECTRONICS FIELD**. We train you at home for these fascinating job opportunities, with the help of one of the most effective, interesting methods imaginable—instructive **MOVIES**.

We provide you with the kind of training aid that industry and our armed forces are using so effectively—the kind of training that some predict will become one of postwar's most effective methods of instruction. You get this outstanding aid-to-learning **NOW**—right in your own home—with DeForest's Training. Send coupon below for big free book. It gives complete facts.



YOU ALSO GET HOME SHOP TRAINING

133 FASCINATING EXPERIMENTS

Build and operate **SCORES** of fascinating projects at home, such as a **SHORT WAVE RECEIVER**, an **ELECTRIC EYE CONTROL**, an **AVIATION BAND RECEIVER**, etc. DeForest's handy "Block System" enables you quickly, easily to re-arrange your parts to build many other workable units. You "**LEARN BY DOING**", at home. Mail coupon promptly for facts about DeForest's Training—and the many grand opportunities today in **RADIO** and **ELECTRONICS**.

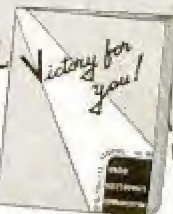
DeFOREST'S TRAINING, INC.

2531-37 N. Ashland Avenue
Chicago 14, U. S. A.

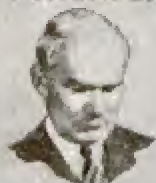
YOU WORK WITH THIS
GENUINE
DeVRY PROJECTOR

But that's not all! Besides (1) instructive **HOME MOVIES** on Radio, you get (2) 90 modern loose-leaf lessons prepared under the supervision of **DR. LEE DeFOREST**, and (3) actual Radio experience at home with 8 kits containing many standard **RADIO ASSEMBLIES** and **PARTS**—major home-training advantages to help you get a real working knowledge of Radio quickly! DeForest's Training prepares you well! Also our effective Employment Service helps you get started!

BUY U. S.
WAR BONDS



LET THEIR EXPERIENCE GUIDE YOU



Radio-Electronics Authority, Dr. Lee DeForest supervised preparation of DeFOREST'S TRAINING.

PUT
YOURSELF
IN THIS
PICTURE



Dr. Herman A. DeVry—often called "Father of Visual Education"—founded DeFOREST'S TRAINING.

DeFOREST'S TRAINING, INC.

2531-37 N. Ashland Ave., Dept. F.
Chicago 14, U. S. A.

Please send me **FREE** your big illustrated book "**Victory For You!**" which tells me how I may get your Home Movie Radio Training and Home Laboratory Kits.

Name _____ Age _____

Address _____ State _____

City _____

Do not reply if under 17.

Mail This Coupon

LEARN

AIRCRAFT DRAFTING

from **RYAN**

TRAIN NOW IN LEISURE TIME BY NEW HOME STUDY METHOD

Now is the time to prepare for Essential War Work and a Brilliant Peacetime Career in Aviation. Ryan's tested methods of instruction will train you thoroughly — yet quickly, in spare time. No higher education or experience necessary. A complete Aeronautical Drafting outfit is included with your training, at no extra cost.

LIFETIME CAREER AT BIGGER PAY

The aircraft industry needs Draftsmen and Engineers Now and for the Big Tomorrow in Aviation. Men who today hold ordinary routine jobs will be important figures in the aircraft plants tomorrow. Prepare yourself now. Send coupon for Free book entitled "New Horizons of Opportunity." To save time send air mail.

FREE
24-page
BOOK

Ryan Aeronautical Institute,
4211 Lindbergh Field, San Diego, California.

Gentlemen:
Please send me your FREE 24-page book, "NEW HORIZONS OF OPPORTUNITY," and full information on R. A. I., including cost of training, and job opportunities.

Name..... Age.....
Street.....
City..... State.....

HOW I STEPPED *into a* Big Pay HOTEL JOB!

Without Hotel Experience, W. Bradley Hall Becomes Hotel Manager Increasing His Income 50%

"When I enrolled in the Lewis School, I was a Railroad Conductor. Shortly afterwards I went to work in a Chicago hotel. Within 60 days I was made Superintendent of Service. Within a year I was earning 50% more than in my previous position. Later I became Manager of an Iowa hotel, and recently took over the 'Y' Cafe and am my own boss. I have made good, thanks to Lewis Spare-Time, Home-Study Training."

HOTELS NEED TRAINED MEN AND WOMEN

Thousands of Lewis-trained men and women winning success in the colorful, essential hotel, club and institutional field. They are making good as Managers, Assistant Managers,

Stewards, Hostesses, Executive Housekeepers and 55 other types of well-paid positions. Today our Government's vast wartime housing, food and recreational program swells the demand for trained men and women. Opportunities for Lewis graduates greater than ever; their success has proved previous experience unnecessary in this business where you are not dropped because you're over 40. Good grade school education, plus Lewis Training, qualifies you at home, in spare time. Write your name and address in the margin and mail the ad TODAY for Free Book which tells how you are registered free of extra cost in Lewis National Placement Service.



"I'M HOTEL HOSTESS NOW"

"Discontented with my humdrum routine and salary as clerk, I enrolled for Lewis Training. Now hostess of this beautiful resort hotel, earning a splendid salary. I get as much fun out of the gay parties and entertainment I play on the guests." — Myra M. Banks.

Lewis Hotel Training School
Room BX-385, (22th Year) Washington 7, D. C.

WORKING FOR

Victory



PREPARING FOR Peace



R. C. IDDIGGS
President

On duty with the Army and Navy Fyr-Fyter Extinguishers serve America in all parts of the world. On the home front, too, they help protect the nation against crippling fire losses. Businesses and institutions essential to the war effort can now, under preference rating, secure Fyr-Fyter Extinguishers. After the war, Fyr-Fyters will be available to all. Valuable Fyr-Fyter Distributorships will then be open for our enlarged and improved line. Send us some information about yourself if you would like to be considered for our post-war organization.



THE FYR-FYTER CO.

Dept. 90 Dayton 1, Ohio

Fyr-Fyter

BIGGER PAY THAN EVER!

Local "Store Route" Plan pays men like you big money—steady!—in wholesale business of your own. No car necessary. Sell Vitamins to stores of all kinds. New low retail price, 7 for 10¢, opens vast rich field. Handle this sales-maker, plus 200 other quick profit items. Many nationally advertised. No experience needed. Amazing facts FREE. Write TODAY!

WORLD'S PRODUCTS CO.
Dept. 10-L Spencer, Indiana



PLASTER COMPOSITION
INDIAN CHIEF STATUE
\$2.98 23 1/2 INCHES HIGH \$2.98
WYANDOTTE STATUARY, 17014 Toledo Rd., Wyandotte, Mich.

BACKACHE, LEG PAINS MAY BE DANGER SIGN

Of Tired Kidneys

If backache and leg pains are making you miserable, don't just complain and do nothing about them. Nature may be warning you that your kidneys need attention.

The kidneys are Nature's chief way of taking excess acids and poisonous waste out of the blood. They help most people pass about 3 pints a day.

If the 15 miles of kidney tubes and filters don't work well, poisonous waste matter stays in the blood. These poisons may start nagging backaches, rheumatic pains, leg pains, loss of pep and energy, getting up nights, swelling, puffiness under the eyes, headaches and dizziness.

Don't wait! Ask your druggist for Doan's Pills, used successfully by millions for over 40 years. They give happy relief and will help the 15 miles of kidney tubes flush out poisonous waste from the blood. Get Doan's Pills.

Get into ^{*}**RADIONICS** now

Learn INDUSTRIAL ELECTRONICS TELEVISION & RADIO



Out of the War is emerging the Age of Electronics, with immediate opportunity for you to enter America's new Industry

*Radionics is a general term embracing Industrial Electronics, Television and Radio. Electronics for harnessing the forces of Industry, Television to bring the world's sights into the home. Radio with revolutionary improvements—these are developments that constitute a tremendous field. You can project yourself into this mighty field. You can become part of it. You can earn good pay as a Radionics Expert, with independence insured during and after the war. When the war ends, Radionics will boom even faster than now. But you can't successfully enter this field unless you have TRAINING. Let's speak plainly. You have the desire and you realize the tremendous future of Radionics. But you lack training. So here's the way to get into Radionics. Have National Schools train you right in your home.



How you can qualify as a Technician in the fascinating field of RADIONICS—including Electronics, Television & Radio

National is always in the lead. As industry advances, National offers training to fit. This was never more true than today. National's training covers all phases of Radionics. You learn by following fascinating lesson assignments, based on practical shop-laboratory methods. Instructors give you the same fundamental training that you would receive if you were actually in the school. It's an amazing extension of resident school training.

TESTED HOME TRAINING BY PROVED SHOP-FIELD METHOD

For more than 38 years National Schools has trained thousands of men. Many graduates hold top positions in hundreds of leading industries. Unlike ordinary correspondent courses, National's Radionics Course is based on shop-practice, shop-tested, shop-routine training, adapted to Home Study. Replacing dry text books, fascinating Lesson and Experimental Assignments are provided. Instructors counsel with you. After the first few Lessons, you are qualified to repair Home Radio Sets. Soon you master Communications and Sound Systems. Before you realize it you have practical knowledge of the "workings" of countless Electronics Controls and how Electronics is applied to Industry. When you graduate you are qualified to accept a job that should pay substantially more than you are now earning. This is a real opportunity for you.

NATIONAL SCHOOLS of Los Angeles

presents **HOME TRAINING** IN RADIONICS

**MEN OF ALL AGES
TRAIN FOR**
Radio Servicemen
Electronics Engineer
Studio Technician
Television Expert
Machine Control
Engineer
Communications &
Sound Engineer

TRAINING IS BROUGHT TO YOU. Every day some new development in Radionics takes place. National's instructors are always on the alert to study each new invention and weigh its advantages. The Course reflects this up-to-the-minute checking so that you as a student get the latest first. The more time you can devote to this training the sooner you graduate. The Course is geared to your needs. You keep your present job while learning. Many students, soon after enrolling, earn extra pay by servicing neighbors' Radio Sets and working in established Radio Shops. Many students are men who have already devoted years to Radio and want to improve their abilities by obtaining thorough training in the entire field of Radionics. So, regardless of your age or experience you can increase your pay and insure your future by enrolling.

New opportunity Book, all about Radionics, and FREE lesson mailed without obligation.

ESTABLISHED 1905



Mail This Coupon Today

FREE RADIONICS BOOK & LESSON

NATIONAL SCHOOLS, DEPT. PM-11
4000 SOUTH FIGUEROA,
LOS ANGELES 34, CALIFORNIA

(Paste on a penny postal)

Send Radionics Book, Lesson and full details, post-paid without obligation.

NAME _____ Age _____

ADDRESS _____

CITY _____ STATE _____

DRAFTING BOOKS
SENT **FREE**
ON APPROVAL

5 VOLUMES, BRAND NEW EDITION

For MEN and WOMEN
Beginners or Experts

Written so you can understand every word, by well known engineers. De Luxe modernistic, washable cloth binding, over 1600 pages, hundreds of blueprints, charts and diagrams; prepares you for a good drafting job in mechanical lines. Sent for 10 days' free use if you mail coupon immediately.

Only 15 minutes a day with these WONDER BOOKS can prepare you for a good drafting job. Drafting from simple straight lines to important complex plans. A step at a time! Built especially for beginners, for men with only grammar schooling. Drafting room practice, PLUS ENGINEERING, made easy and clear, 400 pages on tool design, over 200 pages on machine design. Includes special volume on blueprint reading with full size actual production blueprints, some 26"x30", as well as question and answer sheets.

Competent draftsmen are urgently needed in all manufacturing lines at \$30.00 to \$75.00 a week. That's just the beginning—FOR DRAFTSMEN HAVE GOOD CHANCES FOR ADVANCEMENT. Pleasant, fascinating work, easy to learn and do. Learn quickly with these books—send coupon for a set and see for yourself.

A year's consulting service now given to all buyers of this famous encyclopedia of drafting.

AMERICAN TECHNICAL SOCIETY
Vocational Publishers since 1898

American Technical Society, Dept. D013, Drexel at 58th St., Chicago 37, Ill. Send for 10 days' trial, Brand New 5 volume set of "Drafting for Machine Trades." I will pay the delivery charges only. If I wish, I may return books in 10 days and owe you nothing, but if I decide to keep them, I will send \$3.00 after 10 days, then only \$3.00 a month until \$19.00, the total price, is paid. Send Brand New edition and include Consulting Service Certificate.

Name

Address

Please attach letter stating age, occupation, employer's name and address and that of at least one business man as a reference. Men in service, also please give home address.

Big Field • Big Demand • Big Pay

AMERICAN TECHNICAL SOCIETY
Vocational Publishers since 1898

American Technical Society, Dept. D013, Drexel at 58th St., Chicago 37, Ill. Send for 10 days' trial, Brand New 5 volume set of "Drafting for Machine Trades." I will pay the delivery charges only. If I wish, I may return books in 10 days and owe you nothing, but if I decide to keep them, I will send \$3.00 after 10 days, then only \$3.00 a month until \$19.00, the total price, is paid. Send Brand New edition and include Consulting Service Certificate.

Name

Address

Please attach letter stating age, occupation, employer's name and address and that of at least one business man as a reference. Men in service, also please give home address.

NEWS

Increased production means

More Jobs for MACHINISTS
and bigger pay for men who know their work

This big home-study and reference course gives you the practical facts on machines and methods you need to advance in machine shop work. Take advantage of the other man's experience as found in books, to solve your problems, increase your efficiency, with

The AMERICAN MACHINISTS' LIBRARY

6 volumes—2368 pages—2516 illustrations
(A combined home-study course and reference library)

This library of machine shop practice was written for practical men. It gives you the best methods for every kind of machine shop work. It fully explains lathes, drills, and other machine tools and their operation, automatic screw machines, speeds and feeds, gear design and production, fits and fixtures, punch and die work, metal surfacing, etc., etc. Plainly written—completely illustrated—the best kind of help to the machine shop man who wants to advance himself.

No money down—special price—easy payments.

The AMERICAN MACHINISTS' LIBRARY

6 volumes—2368 pages—2516 illustrations
(A combined home-study course and reference library)

This library of machine shop practice was written for practical men. It gives you the best methods for every kind of machine shop work. It fully explains lathes, drills, and other machine tools and their operation, automatic screw machines, speeds and feeds, gear design and production, fits and fixtures, punch and die work, metal surfacing, etc., etc. Plainly written—completely illustrated—the best kind of help to the machine shop man who wants to advance himself.

No money down—special price—easy payments.

EXAMINATION COUPON

McGraw-Hill Book Co., 330 W. 42nd St., N. Y. 38

Send me for ten days' examination the American Machinists' Library. If satisfactory I will send you \$1.50 in 10 days and \$3.00 monthly until the price of \$19.50 is paid. If not wanted, I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

Name

Home Address

City and State

Position

Name of Company

MUSIC LESSONS

COMPLETE CONSERVATORY HOME STUDY COURSES

Piano, Harmony, History of Music, Advanced Composition, Voice, Public School Music, Violin, Cornet, Trumpet, Guitar, Mandolin, Saxophone, Clarinet, Dance Band Arranging, Ear Training and Sight Singing, Choral Conducting. The only correspondence school teaching all the courses leading to the Degree of Bachelor of Music. Ask for illustrated lessons and catalog.

Give experience Age

UNIVERSITY EXTENSION CONSERVATORY 1525 E. 53rd St., Dept. U-35, Chicago, Ill.

Amazing reproduction of our HAND CARVED "MAGIC" LIGHT CRUCIFIX

GLEAMS A LAVENDER GLOW BY NIGHT

GLOWS AT NIGHT

This magnificent reproduction is made of Barroo wood 11" high, BEAUTIFULLY detailed in HAND CARVED STYLE. The cross is of rich Walnut Finish. The image, as well as the halo, are in antique ivory by day—by night, the image GLEAMS A LAVENDER GLOW.

TWO BIG SURPRISE GIFTS FREE FOR ACTING PROMPTLY—IDEAL GIFT, OFFER LIMITED—ACT AT ONCE.

SEND NO MONEY Just write a card or letter. "Please send Reproduction of your original Hand Carved Crucifix for which I will deposit \$1.69 for one; or \$3.18 for two, with postman upon delivery, plus a few cents postal charges." If you send remittance with order, we will prepay shipping charges. Avoid disappointment.

ORDER NOW FOR THE HOLIDAYS.

THE RELIGIOUS HOUSE, DEPT. PM 333 S. MARRET ST., CHICAGO, ILL.

Only \$1.69

Learn PHOTOGRAPHY at Home

Splendid opportunities. Prepare in spare time. Easy plan. No previous experience needed, common school education sufficient. Send for free booklet "Opportunities in Photography", particulars and requirements.

American School of Photography
1315 Michigan Ave., Dept. 1358, Chicago, Ill.

Correspondence Courses in RADIO and ELECTRICAL ENGINEERING

LOW AS \$25

ELECTRICAL ENGINEERING. Get good grasp of wide electrical field. Modern. Very understandable. Theory made easy.

RADIO ENGINEERING. Extra fine course in radio, public address, photo-electric work. Trains you to be expert-service man, radio vacuum tube technician. Tuition ONLY \$25, either course. Deferred payment plan. Servicemen needed badly.

FREE Write for free copies of school catalogs, student magazines, etc.

LINCOLN ENGINEERING SCHOOL, Franklin, S.D., Box 81—P-59
(Formerly at Lincoln, Nebr.) WASHINGTON, D. C.

ELECTRIC MOTORS

General Electric 3/4 h.p.; 1750 r.p.m.; 110 v.; Continuous rating; Standard frame & base; Suitable for saws, grinders, washing machines, presses, pumps, stokers, jig saws, band saws, etc.

COMPLETELY REBUILT AND GUARANTEED
Order now! \$12.50. No Priority Needed.
National Appliances, 4814 W. Vernor, Detroit, Mich.

don't WORRY

ABOUT RUPTURE

Why put up with years of needless discomfort and worry? Try a Brooks Automatic Air Cushion. This marvelous appliance permits the opening to close, yet holds reducible rupture securely, comfortably—day and night. Thousands report amazing results. Light, neat-fitting. No hard pads or stiff springs to chafe or gouge. Made for men, women and children. Durable, cheap, Sent on trial to prove it. Never sold in stores. Beware of imitations. Write for Free Book on Rupture, no-risk trial order plan, and proof of results. All correspondence confidential.

BROOKS COMPANY, 158-C State St., Marshall, Mich.

**AUTO REPAIR * REFRIGERATION * WELDING * AIRCRAFT
SHEET METAL WORK * ELECTRICITY * STEAM ENGINEERING**

DO ANY JOB... EASIER... QUICKER MAKE MORE MONEY



**FREE TRIAL
IN YOUR
OWN HOME**

**Used by Army, Navy, Other
Government Departments, 200
Schools and Industrial Firms**

**Here is the HELP YOU NEED...
Now and After the War!**

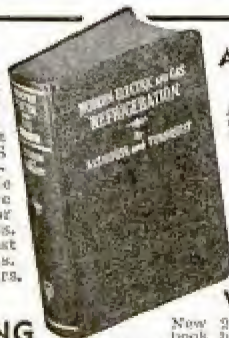
Get ready now for lasting success and patriotic service in America's vast production army. Be ready for keener job competition in after-war days. Top-ranking jobs and many advantages await you if you prepare NOW. Here is the help you need—EASY—QUICK—AT LOW COST. Thousands of successful men have already used these famous books—beginners and experienced men alike. You too, can get from them the special knowledge needed for good jobs in a half-dozen vital, important fields. This is your OPPORTUNITY.

Select the Books YOU Need Now!
**SEND NO MONEY: We Ship Anywhere in U. S. and
Refund Deposit Paid if Books Are Not Satisfactory.**

**LEADER FOR
32 YEARS**

REFRIGERATION

No new refrigerators being made. None for years. Millions must be kept going. Owners will pay big for competent service. Get **MODERN GAS AND ELECTRIC REFRIGERATION**, the non-technical guide to all types, and get your share of this new profit. Get a job or start your own service business. New printing now ready. Almost 1000 pages, 408 illustrations, 17 diagrams in 6 and 8 colors. \$5.00.



AIRCRAFT SHEET METAL WORK

A brand new and practical manual. The one book that should be read by everyone who is working on, or wants to work on modern all metal airplanes. Prepared from personal experience in training men for California plants. 139 pages, 30 pictures, 51 full page projects. \$2.50.

AIRPLANE and WELDING Materials

New 2nd edition of this famous Division, Wright Field. The authoritative and practical book on Airplane welding and materials brought right up to date. 420 pages, 193 pictures. \$3.25.

ELECTRICAL WIRING

Complete practical instruction on every phase of house wiring in one handy volume. Goes farther than most books on subject. Hand-book style. Gives National Electric Code. 400 pages, 609 illustrations. \$2.50.

Rusty on Mathematics?

Then get this short cut to the mathematics all shop men must have to be successful.

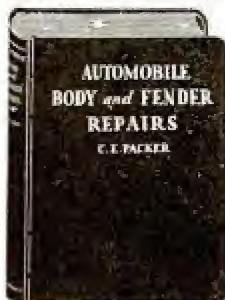
Vol. 1 Shop Arithmetic (cloth)\$1.50
Vol. 2 Shop Geometry, Algebra, Trigonometry, (paper)\$1.50

Auto Body and Fender Repair

Owners will spend big money to keep cars looking new! Auto Body and Fender Repair contains 325 pages, 232 illustrations. Covers methods, tools, etc., in plain, simple language. \$3.00.

DYKE'S CARBURETOR BOOK

The standard guide for a generation. New edition covers engine tune-up, ignition, carburetion, fuel pump, valves, etc. 244 pages, 549 illustrations. \$3.00.



BAILEY'S HANDBOOK

The standard handbook of Universal Questions and Answers for Stationary, Marine and Diesel Engineers and Firemen. The one book needed by old timers and candidates for license. Pocket size. 277 pages. \$2.00.



World's Greatest AUTO BOOK

NEW 20TH EDITION

New Material on Transmissions, Trucks, Tractors, Diesels, Aircraft Engines

Over a half million copies of 32 editions of Dyke's have been sold. Gives specifications of old and new cars.

Now with millions of cars needing repairs and thousands of men needed to do the work, you need the famous DYKE Auto Book more than ever before. Brand new 20th Edition covers all principles, construction, repair, adjustment, testing, troubles and remedies of all cars. Price \$6.00

This big book, a complete auto library in one volume, has 1483 pages—4600 illustrations and diagrams—weighs 6 pounds.

SEND NO MONEY! Mail Coupon

GOODHEART-WILCOX CO., 2011 S. Michigan Ave., Chicago
Send books checked, C.O.D. I will pay postman, plus few cents charges. If any book is not satisfactory I will return in 5 days and you will refund money paid you.

☐ Gas & Electric Refrigeration\$5.00
☐ Modern Welding\$4.00
☐ Dyke's Auto Book\$6.00
☐ Aircraft Sheet Metal\$2.50
☐ Airplane Welding\$3.50
☐ Bailey's Handbook\$2.00

☐ Sheet Metal Layout\$3.00
☐ Elect. House Wiring\$2.50
☐ Dyke's Carburetor Book\$3.00
☐ Body and Fender Repair\$3.00
☐ Shop Mathematics
☐ Volume 1\$1.50
☐ Volume 2\$1.50

If remittance accompanies order we will pay all postage charges under same return privilege.

Name

Address

City..... State.....

GOODHEART-WILCOX CO., INC.

*** 2011 S. Michigan Avenue, Chicago ***



110,000 ENTRIES
1800 ILLUSTRATIONS

DEFINES all the most commonly used words, selected from WEBSTER'S NEW INTERNATIONAL DICTIONARY, Second Edition, "The Supreme Authority." 1300 pages; \$3.50 to \$8.75, depending on bindings. Purchase at bookdealers or direct from publishers. Write for FREE Quiz and Picture Game to G. & C. Merriam Co., 404 Federal St., Springfield 2, Mass.

The BEST Handy Size DICTIONARY

A Merriam-Webster

DRAFTSMEN NEEDED Now



Industry is clamoring for more draftsmen for the job can't start until plans are drawn. Buildings, airplanes, machines, guns, tanks, bridges, all start on the drafting board, so it's no wonder that every good draftsman has a fine job. Yes, more draftsmen are needed NOW. The pay is good and the opportunities for advancement great.

Learn at Home in Spare Time

Begin now to turn spare hours into money. Be a draftsman, the connecting link between a mechanic and an engineer. Enjoy the wonderful opportunities for promotion that exist now. No experience or artistic talent is needed. You don't have to leave your present job while learning. Use spare time.

American School, Dept. DD445, Drexel Ave. at 68th St., Chicago 37, Ill.

Gentlemen: Send me FREE information covering special training in subjects checked below. No obligation on my part.

<input type="checkbox"/> Drafting and Design for Men and Women	<input type="checkbox"/> Electrical Engineering
<input type="checkbox"/> Cost Accounting for Manufacturing	<input type="checkbox"/> Diesel Engineering
<input type="checkbox"/> Architecture and Building	<input type="checkbox"/> High School Course
<input type="checkbox"/> Automotive Engineering	<input type="checkbox"/> Plastics
<input type="checkbox"/> Business Management	<input type="checkbox"/> Mechanical Engineering
	<input type="checkbox"/> Aviation <input type="checkbox"/> Radio
	<input type="checkbox"/> Shipbuilding

Name.....
Address.....

FALSE TEETH

AVOID LOOSE, SLIPPING

GUM GRIPPER

NEW PLASTIC DISCOVERY TIGHTENS THEM QUICKLY

EAT in Comfort TALK in Comfort LAUGH Freely

Apply It Yourself—AT HOME

Now—in a jiffy—you can make loose, slipping dental plates fit snug and comfortable. Just apply amazing new Plastic "Gum Gripper" dental plate re-liner. Squeeze on with handy tube. Wear plates while they set. Before you know it, dental plates fit like new once again. NOT A PASTE, POWDER OR WAX. Can be scrubbed or washed. One application lasts up to 4 months—or no cost. It's tasteless.


FREE Offer Generous size DENTAL PLATE Cleanser included free of extra cost with each order. Cleanses dental plates without brushing. Will not fade or harm the denture.

Send No Money! — Test at Our Risk!

Send name and address. When package arrives, deposit \$1.00 plus postage with the postman. If not satisfied 100%, return the used tube and your \$1.00 will be refunded. If \$1.00 is sent with order, we pay the postage. Don't wait—Write today!

WEST LABS., 127 N. Dearborn St., Dept. A-71, Chicago

RADIO OPERATORS WANTED



Learn to Send and Receive Radio Code at home or in camp, or prepare for higher proficiency and rating through easy, practical system used in training radiotelegraph specialists. Thousands of operators needed. Write for FREE book.

CANDLER SYSTEM CO.
Dept. S-M, Box 928, Denver 1, Colo., U. S. A.

A SIMPLIFIED ART ANATOMY OF THE HUMAN FIGURE

by Charles Carlson. The book they're talking about! One of the most informative books of its kind for both student and professional artists. Charts, notes, and over 350 drawings show detailed studies of every part of the body, posed and in action.

ONLY \$1 POSTPAID

HOUSE OF LITTLE BOOKS, 158-160 Fifth Ave., New York

KEY TO A PRACTICAL UNDERSTANDING OF ELECTRICITY

AUDELS HANDY BOOK OF ELECTRICITY

\$4 HANDY SIZE

For Engineers, Electricians, Students and all interested in Electricity. A quick, simplified, ready reference, giving complete instruction and practical information. Easy to understand. A reliable authority and a handy helper that answers your questions.

INSIDE TRADE INFORMATION ON

The Rules and Laws of Electricity—Maintenance of Machinery—A. C. and D. C. Motors—Armature Winding and Repair—Wiring Diagrams—House Lighting—Power Wiring—Cable Splicing—Meters—Batteries—Transformers—Elevators—Electric Cranes—Railways—Bells—Sign Flushers—Telephone—Ignition—Radio Principles—Refrigeration—Air Conditioning—Oil Burners—Air Compressors—Welding, and many Modern Applications explained so you can understand.

1340 PAGES 2600 ILLUS.

Get this assistance for yourself, simply fill in and mail the FREE COUPON below.

THEO. AUDEL & CO., 49 West 23rd Street, New York

Please send me "Audels Handy Book of Practical Electricity" for free examination. If satisfactory, I will send you \$1 in 7 days, then \$1 monthly until \$4 is paid. Otherwise I will return it.

Name.....
Address.....
Occupation.....
Reference..... P.M.

READ FOR PROFIT!

Say you saw it in Popular Mechanics!

Learn to Mount Birds and Animals—Send Coupon for Free Book!

HELLO, SON. SPENDING THE EVENING AT YOUR WORK-BENCH AS USUAL?

COME IN, DAD. I WAS JUST READING THIS AD OF THE NORTHWESTERN SCHOOL OF TAXIDERMISTRY. IT SAYS THAT MOUNTING BIRDS AND ANIMALS IS A GREAT HOBBY FOR THE MAN WITH A WORK-BENCH—AND PROFITABLE, TOO. WHAT DO YOU THINK?

WELL, SON, I DO KNOW THAT THAT SCHOOL WAS TEACHING TAXIDERMISTRY WHEN I WAS YOUR AGE—THIRTY YEARS AGO. I OFTEN WANTED TO LEARN IT MYSELF.

IF IT'S AS INTERESTING AS IT SOUNDS, I'M AT LEAST GOING TO INVESTIGATE. AND I COULD SURE USE SOME EXTRA MONEY RIGHT NOW—ALICE WANTS A NEW DRESS AND I'D LIKE A NEW SET OF TOOLS.

NOT SO BAD FOR A BEGINNER. THERE'S A LAMP THAT WILL LOOK DANDY IN MY DEN. GUESS I'LL ASK DAD TO DROP OVER TONIGHT AND TAKE A LOOK.

THAT SQUIRREL BOXING GROUP IS ONE I MADE FOR GREEN'S SPORTING GOODS STORE FOR A WINDOW DISPLAY. SO FAR THIS MONTH I'VE BOUGHT THOSE THINGS I WANTED, AND MADE MY WORK-BENCH PAY ME AN EXTRA \$68—JUST FROM TAXIDERMISTRY.

AND I NOT ONLY MOUNT TROPHIES FOR OTHER SPORTSMEN, BUT MOUNT MY BEST ONES FOR THE DEN HERE. WHY DAD, I NOW GET TWICE AS MUCH FUN FROM MY HUNTING AS I USED TO. YOU WOULD TOO IF YOU LEARNED TAXIDERMISTRY.

IT SOUNDS GREAT, SON. WHEN DO I START?

WHY BOB, YOU CERTAINLY DID TAKE UP TAXIDERMISTRY IN EARNEST, DIDN'T YOU?

I SURE DID. I'VE MADE AND SOLD A BUNCH OF BOOK-ENDS, MIRRORS AND SO ON TO HUNTERS FOR THEIR DENS. AND FUN? SAY DAD, TAXIDERMISTRY'S THE GRANDEST HOBBY IN THE WORLD!

Fun—Fascination—Profits

Be a Taxidermist. All Secrets Revealed. Learn at Home



Save Your Hunting Trophies

Mount (stuff) expertly your valuable **game-birds, animals, fish, game-heads**. Preserve them just like **life**. That is Taxidermy. Learn at home by **mail**. Decorate home and den with nature's art. Make undreamed-of **profits** in spare time, in your shop. You can. Will you? Win fame as a taxidermist. Investigate. Mail **coupon NOW**.



Fun With a Few Loads

Yes, **war** makes shot-gun shells scarce. But just a **few shells** obtain a **few ducks**, and with **taxidermy**, you will have the grandest hunting season **ever**. Taxidermy is fine beyond description for **men and boys**. Be one of our 300,000 students. We invite **young men**, boys, youths.

"Eat your Trophies and have them too"



Mail Coupon

Or a postcard will do. No obligation on your part. The beautiful **Book**, with hundreds of entrancing **Pictures** is **Free**. Don't miss your **Only Chance** to get this remarkable book **Free and Postpaid**. Write today. State your **Age**.

Northwestern School of Taxidermy
3378 Elwood Bldg. Omaha, Neb.

Wild Game Not Needed

Use **common** specimens; squirrels, rabbits, chicks, pets, owls, pigeons—even frogs. Make useful articles like those shown here. Mount them in human and humorous positions. This is craft and novelty taxidermy. It's **fun—and profitable**. All included in our unique lessons. It's **marvelous**. Write the school this minute.

BIG PROFITS From Your Shop in Spare Time

Many students earn from \$40 to \$75 monthly in spare time. Some earn thousands of dollars each year. Sportsmen bring their trophies to be mounted. Besides you can sell your own **Novelty** groups for homes, dens and for merchants' window display.

LEARN TANNING

The lessons teach tanning harness; sole, crone leather; also furs. Expert methods. Very profitable.

FREE BOOK

Northwestern School of Taxidermy, 3378 Elwood Bldg., Omaha, Neb. Gentlemen: Please send at once, your free 48-page book on Taxidermy without any obligation on my part. Tell me how I can learn Scientific Taxidermy at home.

Name..... Age.....

Address.....



**WORLD'S
BEST
WANT AD
MEDIUM**

CLASSIFIED Advertisements



Advertisements in this section, 35 cents per word, each insertion, minimum 10 words, payable in advance. To be inserted under proper classification in December issue, copy should be in our office October 8th. December issue on sale November 1st. Popular Mechanics Magazine, 200 East Ontario Street, Chicago, Illinois

AUTOMOBILES, MIDGET CARS

SEND \$1.00 For large photographic cuts showing midgets, racing cars, speed boats, speed equipment, quick change gear boxes for midgets, overdrive transmission for hydroplanes 225 and under, and price sheet. R & R Mfg. Co., Robert M. Roof, Box 546, Anderson, Indiana.

EXTREMELY Simple method of high rate battery charging, 10 to 150 amperes. Garage and service stations can assemble from materials in stock. Easy simple plans \$2.00. Earl Clifford, 585 20th St., Oakland, Calif.

1943 IGNITION Supercharger \$3.50. Quick starting, mileage, pep. EG Sales Mfg. Co., 60 John St., New York.

RENEW Car batteries inexpensively. Instructions \$1.00. Popular Service, Racine, Wisconsin.

THIS Victory gasoline economizer will increase your mileage on any car, bus or truck to 31% or better. Send 25c coins for complete detailed instructions, diagrams. Modern Advancement, G.P.O. Box 674, New York, N. Y.

1000 MOTORISTS Needed to make gas saving test. Up to 30% savings. For free test offer write Vacu-matic Carburetor Co., 7617-843 W. State St., Wauwatosa, Wis. See our display advertisement on page 184.

SAVE Gas — With "Moto-Purr." — new scientific, laboratory-tested, tablet. Users report saving gas up to 40%. Results guaranteed. \$1.00 package treats 140 gallons. Liberal supply 25c. Free literature. Motor-Aids Company, Ames Station, Omaha, Nebraska.

AUTOMOBILE Racing book, fifth edition, well illustrated. Instructions on building bodies, frames, engines. Ford A and B conversions. Plans, AAA rules, specifications. Roadster racing, Indianapolis cars. \$1.00 postpaid, \$1.15 C.O.D. Ray Kuns, Dept. 47, Madisonville, Cincinnati, Ohio.

PROFESSIONAL Midget racers, motor-scooters, midget cars. Plans, plans. Hand-book catalog—50 illustrations, plans—20c. Midwest, 2557 Charlestown, Toledo, Ohio.

AUTO SUPPLIES AND EQUIPMENT

TWIN Mufflers, California combination set V-8, increases power, saves gasoline, beautiful deep tone, black finish complete \$20. Clymers finest aluminum pistons finished oversize or semi V-8 or Model A \$2.50 each. Clymer spotlights \$4.75. New genuine A-C built Cicco spark plugs, original boxes Model A 3/4, also 18 mm. 45c each postpaid. Motor scooters. Catalog 10c. Clymers, 307 W. Pico, Los Angeles 15, Calif.

WHIRLGAS Turbinator, \$3, gives surprisingly pleasing economical motor performance by spinning and vaporizing carburetor mixture. Wrench installs 15 minutes. Give auto make, year. John Hanley, 5719 Lorraine, Detroit 8, Mich.

USED Parts (guaranteed) all cars. Describe needs fully; immediate reply. Victory, 2439 1/2 Gunnison, Chicago.

SUPERCHARGER For V8 Ford, good condition, mfg. by McCulloch, \$50.00. Box 1344, Lake Charles, La.

OPERATE Cars, trucks, tractors, engines with wood or coal gas. 1/2 price of gasoline, extensively used in Europe. Complete detailed information \$1.00. F. M. Harris, Westby, Wisconsin.

PLATING Outfits for auto parts. Connect to a battery. No tanks used. Free particulars and proofs. Gunmetal Co., Ave. J, Decatur, Ill.

AUTO TRAILERS

PLANS \$1.00 Each. House, sport, camp, utility trailers. Catalog 10c. Jim Dandy, Box 125-A, Wausau, Wisconsin.

MOTORCYCLES, BICYCLES, MOTOR-SCOOTERS AND SUPPLIES

MOTORCYCLE Book—192 page manual "Questions-Answers" complete servicing information Harleys, Indians, Hendersons, Servicycles. Villiers including war models, \$1.10. "Motorcyclist's Workshop" \$1.50. "Two-Stroke Motorcycles" \$1.50. "Historical Motorcycling Facts" \$1.00. "Automobile Racing" \$1.10. "Modern Motorcycle Mechanics and Speed Tuning." 435 pages, care American, English motorcycles \$2.50, with drawings, specifications U. S. Army Jeep, German war motorcycles \$3.00. All postpaid. Clymers, 307 W. Pico, Los Angeles 15, Calif.

BUILD Electric bicycle. No chains, gears, welding. Relay controlled. Plans \$1. Klaus, 1369 Missouri, Pittsburgh, Penna.

100 MILES Gallon! Motor-scooters, motorcycles. Whizzer bicycle engines, midget automobiles, gasoline engines. No priority necessary. Full information, prices, illustrated catalog one dime. Clymers, 307 W. Pico, Los Angeles 15, Calif.

BUILD 5 Different scooters, 3 wheels side by side. Midget, trailer unicycl, air-cooled engine, etc. Large manual \$1.00. Illustrated circular 10c. Craftsman Books, Box 1153-MP, Milwaukee, Wis.

SAVE Gasoline, build a motorbike ch'ap. Send 25c for complete plans. Motorbike Service, 2108 McLean, New Albany, Ind.

RECAP Motor-scooter tires. Information folders 10c. Clymers, 307 W. Pico, Los Angeles 15, Calif.

WHEELS And tires for motor scooters. Bicycles, parts and tires. 10x2.75 wheel and tire ball-bearing, \$8.95. Send dime for list. Cycle Transport Co., 1241 So. Michigan Ave., Chicago, Illinois.

BOYS: All bicycle repair secrets revealed. "Bicycle Repair Manual" 65c. R. G. Klausner, Shelbyville, Ill.

PLANS, Drawings, specifications, instructions for building attractive motor-scooter complete \$2.00. For electrically driven bicycle \$1.50. Postpaid. Clymers, 307 W. Pico, Los Angeles 15, Calif.

PISTONS All sizes for Harley-Davidson, Duckworth chain 3/4x1/4 for motorcycle. McCann's, 2104 Texas Street, El Paso, Tex.

"MODERN Motorcycle Mechanics," 435 pages, 200 illustrations. Extensively covers—operating, maintenance, and complete reconditioning. American and British motorcycles, invaluable to motorcycle riders or mechanics. \$2.50 postpaid. Nicholson Brothers, Saskatoon, Canada.

AVIATION

AIRCRAFT Drafting, fundamentals, 28 project sheets, full instructions. Home or school. Elementary drafting prerequisite. One dollar. Robert Brydon, Jr., 615 City Park Ave., New Orleans, La.

AIRPLANES \$185 Up. Send 25c for latest war-bargain catalogue. Used Aircraft Directory, Athens, Ohio.

NEW Book. Lightplane Manual. Sport-plane Manual. Blueprints for lightplanes, gliders, pontoons. Illustrated circular 20c. Craftsman Book, Box 1153-PM, Milwaukee, Wis.

BATTERIES, GENERATORS, ETC.

EDISON Batteries. Light. Power. Fifteen year life. Five year guarantee. Complete lighting plants. Free literature. See Jay Company, 321 Yonkers Avenue, Yonkers, New York.

WELDING, SOLDERING, PLATING

WELDING, Cutting, aircraft welding and soldering equipment. Electric arc welders. Superior Oxy-Acetylene Co., Hamilton, Ohio.

SLIGHTLY Used arc welders. Recommended by R.E.A. Guaranteed. Forney Mfg. Co., Fort Collins, Colo.

MAKE Own soldering iron. Commercial size. Cost few cents. Tool marker plan included. Plans \$1. C. S. Morgan, 1310 1/2 Third St., Corpus Christi, Texas.

A.C.-D.C. Welding rod coating formula. Coat different size wire. Material cheap, bought anywhere. No priorities. Guaranteed two dollars. B. Wayland, Mantion, Calif.

ARC Welders wanted by the thousands. Learn with 516 page lessons manual. Over 600 how-to-do-it photos. \$2.00 copy. Money-back guarantee. Hobartweld, Box M-1134, Troy, Ohio.

NEW Model electric welder 110 volt a.c.-d.c.; will weld all metals; easy to use; full directions. Complete with power unit, flame and metallic arc attachments, carbons, fluxes, rods, mask; all for \$19.95. Used by the navy. Marvel Electro Welder Mfg. Co., 193-AY Center St., New York City.

BUILD d.c. Arcwelder without rewinding armature. Plans \$1.00 each. 25 to 600 amperes from vehicle motors, light plant generators, automobile starter-generators. Welders Club, AB-3432 M-Mart, Chicago.

ELECTRICAL SUPPLIES, EQUIPMENT

FOR Motors, welders, generators, other electrical items. Write LeJay Mfg., 847 LeJay Building, Minneapolis, Minn.

ELECTRIC Pencil: Writes-engraves all metals. \$1.00 postpaid. Beyer Mfg., 4515-H Cottage Grove, Chicago.

MACHINERY, TOOLS AND SUPPLIES

MICROMETERS Cleaned and adjusted to give you correct measurements. \$1.00. Mail all makes to Micrometer Repair Service, 4424 Mill Creek, Kansas City, Mo.

DIAL Indicators for sale \$8.50 C.O.D. For defense shops or machinists only. Write Amity Products, Box 241A, Waltham, Mass.

RECLAIM Dull and broken drills with No-Way Drill Grinder. Circular free. Tractor-Lite Mfg. Co., Spirit Lake, Iowa.

STEEL Beam trammels for draftsmen, engineers, mechanics. Circular free. Clair Company, Box 92M, Blythebourne Station, Brooklyn, N. Y.

INDEX Heads for sale. Very inexpensive. Sixty-two different divisions. Used on small lathes, drill press, milling machines, etc. Make gears, hobbs, cutters, etc. Very accurate, and durable. Not a toy. Used by defense schools and hobbyists. Write for free folder. Long's Index Heads, 2117 East B St., Torrington, Wyo.

FOR Sale—New and used reamers and milling cutters—not catalogued—furnish your list of requirements for prices. Write P.O. Box 493, Flint, Mich.

NEW Caliper, direct reading, speeds up defense work, cheap. Free illustrated circular. Factory, 811-G East 31st, Kansas City, Mo.

GRIND Drills factory accuracy using E. Z. drill grinding attachment \$5.95. Immediate delivery. E. Z. Manufacturing Company, 327 North California Street, Burbank, California.

13"x5" WILLARD Lathe with rap. No. 2 Pratt & Whitney hand milling machine, four step cone drive. Write for full particulars. Cincinnati Machinery & Supply Company, 217 E. Second St., Cincinnati, Ohio.

GRIND Drills like factory: attachment for bench grinder. Cheap. Factory, 811-B East 31, Kansas City, Mo.

ENGINES, MOTORS, DYNAMOS

FOR Sale. Midget motors at \$2.00 and \$3.00 each. Just authorized by W.P.B. A.C. motors geared to 4 r.p.m. Shaft speed 1250 r.p.m. \$2.00 each prepaid. D.C. motors same specifications \$3.00 each prepaid. Ideal for timing devices, displays, toys, etc. McLaren Products Co., 114 N. W. 1st St., Evansville, Ind.

TWIN Cylinder air compressors \$12.50. Motors—all sizes. Hoffmann, 2740 Coy. Cincinnati 19, Ohio.

WINDING Data. 225 motors, single and three phase. \$1.00. Motor Data Co., Box 7691, Kansas City 3, Mo.

BIG Pay jobs in welding. Complete welding lessons and reference book. 516 pages. 41 lessons. \$2.00 copy. Money-back guarantee. Hobartweld, Box 1135-M, Troy, Ohio.

BOATS, OUTBOARD MOTORS, ETC.

TWELVE Foot flat bottom rowboat. Complete plans 25c. Catalog boat building plans 10c. The Rudder, 15 Murray Street, New York.

USED Outboard motor parts. Outboard Exchange, 1194 Remsen Ave., Brooklyn, 12, N. Y.

MARINE Power—Easily convert any Ford motor (domestic and foreign) with Osco parts and kits. Complete catalogue 25c (coin). Osco Motors Corp., 3827-29 N. Lawrence Street, Philadelphia, Penna.

FULL Size, cut to shape boat patterns. blueprints. 7½ - 38 feet. Illustrated "Build a Boat" catalog, 10c (coin). "How to Build Boats" book, \$1.00. Cleveland Boat Blueprint Co., Station A-55, Cleveland, Ohio.

OUTBOARDS — Save ½. Good used parts, all makes and models. Bargains re-built motors. Crandall Hicks Co., 959 Commonwealth, Boston, Mass.

BOAT Designers are highly paid professionals. Complete course by mail. Catalog. Westlawn, Montville, N. J.

ATHLETIC EQUIPMENT—BODY BUILDING COURSES

SUPER System of natural physical training. Free booklet. Harry Good, 3261-PM Watson Road, St. Louis (9), Mo.

SUPER Ju-Jitsu—lightning defense and attack system. Sensational new home study course now ready! Learn to lick brutes twice your size with only your bare hands. Free details. Nelson Co., 321 South Wabash, Dept. 508, Chicago.

BE Strong, muscular, full of pep. Amazing new body-building course. Write Olympic System, Dept. M, Waterville, Maine.

SPORTING GOODS, GUNS, FISHING TACKLE, ARCHERY, TRAPPING

SEND 10c For list 100 used guns. Frayseth, Willmar, Minnesota.

FAMOUS Mississippi—Catfish bait formula 10c. Geo. Thomas, Mankato, Minnesota.

ELEVEN Good box traps. Complete blueprints, 30c. Wesho-Uco, Box 51, Detroit, Mich.

TIN-CAN Silencer makes 22 sound like airgun. "Teluhow" plans \$1.00. Spencer Laboratories, Akron 3, Ohio.

ARCHERY Equipment: Catalogue free. Mid-West Archery, 2209-A East 75th, Chicago.

USED Guns, bought, sold, exchanged. List stamp. Howe Fur Company, Coopers Mills, Maine.

BOWS—Arrows for recreation, hunting, fishing. Beautiful archery instruction book, 90 pages, 50 illustrations, only 50c. Illustrated catalogue free. Archery, 617 South State, Chicago.

FREE Catalog, flies, lures, materials. Supreme Mfg. Company, Amarillo, Texas.

FOXES, Nine in one day. Trap slyest furbearers. Particulars free. Guaranteed. Write, Estabrook, Sherburne, Vermont.

ANTIQUES, RELICS, INDIAN GOODS, CURIOS

MUSEUM Supply catalogue 25c. Indian relics, identification chart, fossils, curios, den decorations. American Museum Supplies, 6601 Oakbrook, Chicago 31, Illinois.

RELICS, Minerals, coins, miniatures. Catalog 5c. June's Antiques, Northbranch, Kansas.

INDIAN Relics, beadwork, coins, curios, minerals, old glass. Catalog 6c. Indian Museum, Osborne, Kansas.

INDIAN Relics, coins, bills, gems, crystals, curios, etc. Illustrated catalog 5c. 100 ancient arrowheads \$3.00. H. Daniel, Hot Springs, Ark.

SWORDS, Rapiers, daggers, pistols, armor. Illustrated catalog 25c. Robert Abels, 860-A Lexington Ave., New York.

FIELD GLASSES, MICROSCOPES, TELESCOPES

BINOCULARS. Field glasses, telescopes, hobby. Buy, sell, trade. Write. Paul Schueer, Donnellson, Iowa.

MICROSCOPES. Telescopes, binoculars; all scientific, chemical, laboratory apparatus—bought, exchanged. Exclusively our business for fifteen years. Not get-rich-quick speculators. Trial will show we know apparatus, highest prices paid. Harry Ross, 70 West Broadway, New York.

POWERFUL Telescope lens kit—Consists 3" diameter 75" focus objective—50X and 100X astronomical eyepieces—mounting, directions. Optical parts finished. Builds six foot refracting telescope in evening of easy work. Guaranteed show moon's craters, rings Saturn, moons Jupiter, double stars, etc. While they last \$1.95 postpaid, or C.O.D. plus postage. With 50X terrestrial eyepiece \$2.95. Pfeiffer Optical Company, P-11, Sunbury, Penna.

LENSES—Make own telescopes, microscopes, etc. Set No. 201-H 15 lenses, edge slightly chipped. Big 10-page idea booklet \$1.60, postpaid. See other ad under "Cameras and Photo Supplies." Edmund Salvage Co., P.O. Audubon, N. J.

EYEGLASSES—Prescriptions filled. New and repairs. Low prices. Free price list and information. Write Henry Lighter, 208 West 23rd St., New York.

MICROSCOPES! Research, industrial, amateur, accessories. We sell buy repair, exchange. Inquiries invited. National Microscope Exchange, 119 Chambers St., New York, N. Y.

ASTRONOMICAL Telescopes, binoculars, cameras, microscopes; bought, sold, repaired. Send 10c for list of instruments desired. Rasmussen, Box 294, Amsterdam, N. Y.

DOGS, PETS, BIRDS, RABBITS

BIRD Fanciers. American Canary Magazine Monthly. Year's subscription \$2.00. 2639-P N. Halsted St., Chicago 14, Ill.

AMERICAN Angora Handbook—By Allan T. Gilbert. Pres. Federation of American Angora Breeders—over 100 pages covering all phases of the angora industry—profusely illustrated—\$1.50 postpaid. Gilcrest Angoras, Dept. 28, East Haven, Conn.

MONEY Raising rabbits. Investigate. Folder 10c. Close Rabbitry, Tiffin, Ohio.

CUT Meat bills. Raise Belgian Hares. My book tells how. 50c prepaid. Wm. Gibson, 101 North Powell, Columbus, O.

RABBITS: Flemish Giants, New Zealand. Reasonably priced. Franklin Young, Riverhead, Long Island, New York.

CHIN-CHIN Giant Chinchillas. King of rabbits. Most valuable fur. Best meat. Most prolific. Small cost. Large profit. Willow Brook Farm, R.D. 15, Sellersville, Penna.

HELP National defense by producing meat in your back yard raising domestic rabbits. Old and young can do it. Send 25c for booklet and literature to Dept. G. American Rabbit and Cavy Breeders Ass'n, Colorado Springs, Colo.

RAISE Rabbits for profit. Magazine puts you in touch with markets. Copy 10c. Booklet describing twenty breeds and magazine for three months 25c. Address Small Stock Farmer, Dept. 3, Pearl River, N. Y.

PUPPIES. Also supplies, what do you need? Books, colored pictures, descriptions 104 recognized breeds, 35c. Royal Kennels, Chazy, N. Y.

ST. BERNARD Puppies. Champion sired beauties. Franklin Young, R4, Riverhead, Long Island, New York.

FARMS, FARM LANDS, REAL ESTATE

OZARK Land; \$3 acre; terms. Williams Realty, Mt. Vernon, Ill.

ORLANDO, Florida. 5 acres on main highway; good fruit and vegetable land; easy terms; free booklet. Department 10, Box 1944, Orlando, Florida.

STROUT'S Big farm catalog! 68 pages describing hundreds of properties in 18 states from Maine to Florida and west to the Mississippi—many pictures, rock-bottom prices. Write today for this money-saving time-saving book. Free. Strout Realty, 255-P 4th Ave., New York 10, N. Y.

\$4.00 MONTHLY Buys 40 acres productive land. Price \$150.00. Other bargains up to 2500 acres in south Missouri. Box 425-P, Carthage, Mo.

GOVERNMENT Land \$1.00 acre up. Information all states 25c. National Tax Service, 1037A Majestic Bldg., Detroit.

GOOD Farm bargains. Washington, Minnesota, Montana, Idaho, Oregon, North Dakota. Dependable crops, favorable climate. Write for literature, lists describing typical farms. Specify which state. J. W. Haw, 119 Northern Pacific Ry., St. Paul, Minn.

40 ACRES Good land \$200—\$5.00 down, \$5.00 monthly. H. W. Stewart, Inverness, Florida.

SEE The Highlands of Louisiana where winter brings no idle acres. Choice cut-over land at low prices with terms. Send for descriptive book without obligation. Long-Bell Farm Land Corporation, 896 R. A. Long Bldg., Kansas City, Mo.

40 ACRES. Near White River, unimproved; poultry land. \$190, \$5 down, \$2 monthly. Free list and literature. Hubbard, 216 Grossman Bldg., Kansas City, Kans.

POULTRY, FARM SUPPLIES

ALL The news of poultry! Marketing, discoveries, breeding, feeding, laying. Subscribe now! One year 25c; 5 years, \$1.00. Poultry Tribune, Dept. 151, Mount Morris, Ill.

YOUR Greatest poultry problem will look simple when you read American Poultry Journal regularly. 500,000 poultrymen do, why not you? Only 25c year, 5 years \$1.00. American Poultry Journal, 533 S. Clark, Chicago.

KNOW How to raise poultry for profit. Read Northeastern Poultryman. Every issue packed with helpful hints and practical suggestions. Latest articles on breeding, feeding, and management. Read nationally. Subscribe now. 1 year 65c; 2 years \$1.00. Northeastern Poultryman, 4M Park St., Boston 8, Mass.

PROFITABLE OCCUPATIONS

REFRIGERATION And air conditioning: This billion dollar industry headed for one of biggest postwar money-making booms. Thousands of new servicemen and dealers will be needed. Be ready to cash in on new opportunities ahead. Get acquainted with the industry through reading Air Conditioning & Refrigeration News, \$4 per year, 52 issues. Write Business News Publishing Co., Dept. 2113, 5229 Cass Ave., Detroit 2, Mich.

MECHANICALLY Inclined men — Own and operate general appliance repair shop. Complete, illustrated course shows you how. Welding, refrigeration, motor repair, how to get business, etc., all phases covered. Free literature. Christy Supply Dept. 434, 2835 N. Central Ave., Chicago.

WELDING Pays. Learn with 1942 trade school text manual. 516 pages. Over 500 photos. \$2.00 copy. Money-back guarantee. Hobartweld, Box M-1133, Troy, Ohio.

LEARN Refrigeration service. Open your own shop. Illustrated home training course, reasonable. Opportunity for older men. Free booklet, Mechanics School, Dept. F22, 4701 W. Pico, Los Angeles 6.

ANNOUNCING New home study course in commercial baking. Good field. Nearly depression proof. Common school education sufficient. Send for free booklet "Opportunities in the Baking Industry" and requirements. National Baking School, 1315 Michigan, Dept. 3438, Chicago.

EXCELLENT Sparetime profits handling subscriptions—2500 magazines. Confidential catalogue. Starting supplies free. Pines Subscriptions, Flushing, N. Y.

BECOME A theatre manager. Experience not essential. Informative career book shows how. Price \$1.00. Theatrical Publications, P.O. Box 554, Grand Central Annex, New York City.

LOCKSMITHING Course—Practical in expensive lessons for handy man. Just cut! Fit keys, pick locks, de-code, make masterkeys. Satisfaction guaranteed. Send for free details. Nelson Co., 321 South Wabash, Dept. 708, Chicago.

STANDARD Rabbit Journal, Milton, Pa. 3 years \$1.00, sample dime.

\$40.00 WEEKLY. Made growing mushrooms, fresh, dried. Dominion patent 331583. Free spawn. North American, 169P Yonge, Toronto, Canada.

RAISE Angora rabbits—wool brings \$5.00 pound. Particulars free. Grinstead's, Edwardsville, Illinois.

SOW \$1.00 Worth seeds, harvest \$40.00 profit. Names seeds 25c. Lightning Seeds, Streator, Illinois.

BOOKS, PERIODICALS, PICTURES, POSTCARDS

BUSINESS, Vocational, diversion magazines. Current single copies. Choose from 560 different publications covering aviation, automotive, air conditioning, beverage, confectionery, containers, electrical, live stock, music, photography, plumbing, printing, radio, refrigeration, upholstery, watchmaking and more than 150 other fields. List with prices free. Commercial Engraving Publishing Company, 34C North Ritter, Indianapolis 1, Indiana.

WORLD'S Two greatest bridges. San Francisco! 5 different postcard views, 10c. Rayco, Moss Beach, California.

REBINDING: We bind magazines, old books, Bibles, hymnals. Heckman Bindery, Dept. D, North Manchester, Indiana.

EDUCATIONAL. Interesting books, Novelties, opportunities, etc. Free lists, Circulars. Maumes Sales Service, 1009 E. Creighton Ave., Fort Wayne 5, Indiana.

FREE List, world's best technical books for home training. Metro, 711-P So. Dearborn, Chicago.

A RATIONAL View of Life 50c. Benjamin Seibert, Urbana, Ohio.

COPY Midget Advertiser, 28 pages, 5c. Bill Patrick, Marengo 7, Illinois.

INVISIBLE Glasses. (Contact lenses.) Replace eyeglasses. Informative, authentic, descriptive booklet, 25c. Service Publishers, 1232-A E. 57th, Chicago.

WHAT Every Mason wants. We have Masonic books for Blue Lodge, Chapter, Commandery, Scottish Rite and Shrine. Our rituals are used the world over. Send for free catalog of books and rituals for Masons, Odd Fellows, Knights of Pythias, Knights of Columbus, Elks, etc. Ezra A. Cook, Publisher, Inc., P.O. Box 796, P. Chicago 90, Ill.

THE Latest manual on multispeed three phase motors. Includes NEMA standards, connection diagrams, 2 to 36 poles, watt-meter, coil pitch, etc. Price \$2.00 or write for more literature. Electric Generator Mfg. Co., 1333 No. Dale St., St. Paul 3, Minnesota.

BOOKS, Cards, novelties, samples, catalog 10c. Eastern Sales, 330 South Wells, Chicago.

25 THRILLING "Pin-up" beauties from Hollywood art photos. (Exclusive release.) \$1.00. Libman Co., Dept. E, Box 7833, Del Valle Sta., Los Angeles.

EXCELLENT Sparetime profits handling subscriptions—2500 magazines. Confidential catalogue, starting supplies free. Pines Subscriptions, Flushing, N. Y.

BOOK Of Adam, completes Bible lineages to living persons. Price \$1. Adam lineage, 25c. Harold Bowen, Dept. J, Osceola, Mo.

SELF-EXPLAINING Bible: Illustrated circular free. Box 446-P, Minneapolis, Minn.

25 ART Pictures and catalogue 25c. Curtis' Specialties, Box 1916, Denver, Colo.

5c **BUYS** Back-dated magazines. Foreign, domestic, arts. Catalogs 10c. Gleason's Magazines, 863 First Ave., New York 17, N. Y.

GIRLS Classic! Pictures, new series. Reproduction of original paintings. 50 pictures, \$1.00, postpaid. Each one different, postcard size. Scott's, Box 342, Covington, Kentucky.

"WHEN Will this war end?" What comes afterwards? Answers by the greatest seers and prophets of all times. Write Peerless Books, Box 3810, Chicago 54, Ill.

BOOKS. (Out-of-print, new, used) quickly supplied. Many 35c bargains. Catalogue. T. Jamkowski, 18870 Marx Ave., Detroit, Mich.

ARTISTIC Girl pictures. Real models, 40 photos, \$1.00, 8 for 35c, postpaid. All different, postcard size. Scott's, Box 342, Covington, Ky.

DRUNKENNESS Is a disease which responds to treatment. Medical skill plus human sympathy prove successful with liquor and drug cases. 40 years experience. Write for free booklet. F. M. Nelson, The Keeley Institute, Dwight, Ill.

MAGIC TRICKS, PUZZLES, JOKER NOVELTIES

LEARN 5 Spirit mind reading acts 50c. Three fortune telling charts 25c. Eight great tricks, be a handcuff king, escape from a safe or vault, crack marksmanship, leviathan act, rope tie, trunk escape, 75 ft. rope escape, vanishing act 25c. Two complete handwriting graphocharts 25c. All yours for \$1.00 postpaid. Circulars free. Brain's Book Shop, 118 Washington Ave., Endicott, N. Y.

500 TRICKS You can do! Douglas' famous catalog of 500 tricks, 128 pages, now only 10c. America's fastest service on magic for pocket, parlor, stage, professional, amateur. Douglas Magic Shop, Box 274, Dallas, Texas.

EARN Money in any crowd. Call names of strangers, tell unspoken questions. Professional course mind reading, spirit writing, etc., \$1. Henderson, Box 341, San Bernardino, Calif.

FIRE Eating, swap, magic. Manly, 1315 Ferris, Los Angeles 23, Calif.

MAGIC Tricks, puzzles, books, cards, punch boards. Catalog 10c. Specialty, Box 671, St. Louis 1, Mo.

HOLLYWOOD Special! Magicians button, catalogue, ghost illusion and free trick for 25c. Magic House of Charles, Box 888, Hollywood, California.

EARN Money. Answer unspoken questions, call unknown names, birthdates, articles. Professional mindreading course, \$1. Magical Enterprises, Box 111P, Roseville, Mich.

TRICKS. Secrets, cards, punchboards, etc., explained. Big illustrated circular free. Mack, Box 1275, San Francisco.

LEARN Ventriloquism. 3c stamp brings particulars. Smith, 801 Bigelow, Peoria, Illinois.

YOUR Name screaming headlines. Hollywood newspaper 25c. Lefavor, Arrowhead Springs, San Bernardino, Calif.

MAGICIANS' Headquarters. 216-page catalog, pocket, parlor, professional tricks, 25c. Kanter's, M-1311 Walnut, Philadelphia.

BE A magician. Large professional magic catalogue of latest tricks 25c. Ireland, C-109 North Dearborn, Chicago.

WORLD'S Largest professional magic shop keeps you in touch with latest tricks. To receive mailings send 25c for 1943 catalog. Holden, 220 W. 42nd St., New York.

NEW Vanishing key and catalog 25c. Sterling Magic, 346 John R, Detroit, Mich.

OLD STAMPS WANTED

I WILL Pay \$100.00 each for 1924 1c green Franklin stamps, rotary perforated eleven (up to \$1,000.00 each unused). Send 6c today for large illustrated folder showing amazing prices paid. Vernon Baker, (PM-311), Elyria, Ohio.

STAMP COLLECTING

FREE. The United States has issued its most remarkable series. 12 stamps, each showing the flag in full colors of over-run nations. Our contribution is a special album worthy of housing these colorful and historic stamps. It's a fine album, 34 pages with front cover by a famous artist, artistically arranged and telling the history of each of the 12 nations so honored. We will send it free for 10c handling and mailing expenses to serious approval applicants. Send for yours today and kindly state whether approvals shall consist of U. S. or foreign or both. Approval Headquarters, Globus Stamp Company, 268-4 Avenue, New York City 10, Dept. 201.

FIND Stamps worth fortunes! Six big items! "Queer Countries" packet; Djibouti, Quailor, etc. Packet scarce Russia, catalog price 50c! Fine packet of 25 different British Colonies—Turks and Caicos Islands, Hyderabad, Jamaica, etc. United States \$1.00 and \$5.00 high values. Big "Far East" packet of 30 different stamps from Dutch Indies, Siam, Philippines, etc. Illustrated 32 page booklet—tells where to look for, and sell, stamps worth up to \$10,000 apiece! Everything for only 5c to approval service applicants! Mystic Stamp Company, Department 80-R, Camden, New York.

POSITIVELY Greatest free offer—Latest Scott's International \$4.00 Stamp Album—covering entire world, contains 36,000 illustrated, descriptive spaces. Scott's 1944 Standard \$5.00 Catalogues "Philately's Encyclopedia"—absolutely free to applicants for foreign approvals becoming customers. Plymouth, A-9, Bell, California.

100 ALL Different U. S. 10c. Monjar, 1750 Fairmount, Cincinnati, Ohio.

PHILIPPINES. 20 Different, 20c. No approvals. Mayfield, Route Three, Chattanooga 9, Tenn.

SCARCE Samoa, Perak, Albania, Free French, Georgia, Guatemala, Malaya, Costa Rica, Bolivia, Anzacs, etc. 10c to approval applicants only. John Cobleigh, 8435 Abington Rd., Detroit 27, Michigan.

HAWAIIAN Republic. 3 var., 10c with approvals. Henry Hunt, Box 539, Chico, Calif.

U. S. British Colonials, airmails, commemoratives. Approvals at attractive prices. Riedell, Greensburg, Penna.

FREE 25 Different Canada. Approvals. Knight, Box 3780, Portland 8, Oregon.

WASHINGTON Bicentennial, 12 var., complete 10c. Herman Kleinman, Jenkintown 4, Penna.

TUNISIA, Russia, India, Philippines, Jamaica, Canada. 3c with approvals. Smith, 237-A 8th Avenue, Roselle, N. J.

LATIN-AMERICA—Nice packet, 100 different, only 10c with approvals. "Crescent Stamps," London, Canada.

ONE Of America's oldest approval houses will buy large collections and better grade stamps, \$5,000.000 available. McKelvin Company, Vineland, N. J.

60 DIFFERENT United States—old issues, high values, etc. 10c. Charles Stone, 2347 28th St., Astoria, N. Y.

GERMANY B79-A1 23c with 1/2-1/2-1c approvals. Carroll's, 745A W. 45th, Los Angeles, Calif.

SMOKY Mountain sheet 7c; approvals. Guy Freese, R.R. 8, South Bend, Ind.

FOR Sincere approval applicants, 150 different stamps, only 25c. V. V. Adams, P.O. Box 59, Lewiston, Maine.

APPROVALS. Want lists, new issues. Any country. Melbees, 149-36 Beech, Flushing, New York.

SOUTH Pacific—30 different, 25c. No approvals. Elsas, Bowling Green, Ohio.

AIRMAILS—30 Different 10c with approvals. Special discounts on purchases over 50c. Padlez, Jamesburg, New Jersey.

60 DIFFERENT United States 10c. Pricelless free. Seidenberg, Baroda, Mich.

FINE Approvals, freshly mounted. Fast, personal service. Tell me what countries you prefer and I'll send their stamps. Skinner, 345 E. Ocean, Long Beach, Calif.

500 U. S. Well mixed, many commemoratives, 60 varieties guaranteed, only quarter and 3c stamp. Hogan's Stamp Shop, Ashland, Wis.

BEAUTIFUL Mexican set 5c with foreign approval applicants. Yokums, Box 1327, San Antonio, Texas.

200 DIFFERENT 25c. Six miniature sheets 25c. Box 180, New York 19.

JUMBO Foreign approvals. Selections of 250 stamps. Beaumont Stamp Exchange, 2607 McFaddin, Beaumont, Texas.

APPROVALS United States and general foreign. Cal's Stamp House, Roseville, Michigan.

WASHINGTON Bicentennial set 5c with applicants for U. S. approvals. Yokums, Box 1327, San Antonio, Texas.

UNITED States, Canada, Newfoundland approvals upon request. Dan Hayden, 1007 N. Evans St., Bloomington, Ill.

FIFTY Stamps five cents requesting approvals. Stamp Lure, 2160 So. Lincoln, Denver, Colorado.

FREE—Four Manchurian commemorative sets with approvals. Garfield, 501 Garfield, Cadillac, Michigan.

FREE. Complete Cuba tobacco set with approvals. Seminole, Glenburnie-1, Md.

BEGINNERS!—Penny approvals, premium. Kress, 212 West Walnut, Hanover, Penna.

UNITED States specialized approvals. Attractive prices. Tropical, 31 NW 77th Street, Miami-38, Florida.

GENERAL—Check list—Booklet free to every customer. Original set-up. Write for our new price lists or send want list. Liberty Circle, 127 Nassau St., New York 7.

10 DIFFERENT Iraq 10c, approvals. Pinehurst Stampco, 90 Pinehurst, New York 33.

FOUR Star super packet—Only 12c. Includes airmails, commemoratives, pictorials, war issues! 217 stamps from the U. S., British Empire, South and Central American countries. To approval applicants. Kessels, Box 808, Tucson, Arizona.

U. S. Mixture. 3 pounds \$1.00. Holmes Stamps, New Albany, Ind.

FREE! St. Pierre ships. Approvals. Send 3c postage. Buchanan, 307 East 23rd, New York.

CANADA'S 1943 Scarce used 10c airmail 20c. Dufort, 4402 Chateaubriand, Montreal, Canada.

BIG Packet, 10c beginners' approvals. Claire Ownby, 4004 Gillon, Dallas, Texas.

127 DIFFERENT Stamps including Free Fighting French, Haiti, Johore, Perak, only 10c to approval applicants. Reich Stamp Co., 4647 Keonmore, Chicago, Dept. M7.

20 SOUTH America, 1c with approvals. Super Stamp Shop, 6 S. Madison, Greencastle, Indiana.

175 U. S. Commemoratives, airm. etc. 10c. 500—25c. Box 457, Newark 1, N. J.

UNITED States stamps on approval. Low prices. Box 488, Minneapolis.

STAMP Exchange for adults. Free leaflet. Liberty Stamp Exchange Circle, 127 Nassau Street, New York 7.

FIFTY British colonies and twenty U. S. commemoratives for 3c postage to approval applicants. Pan-Am Stamp Co., Box 1188, Miami, Fla.

WORLD'S Largest diamond and triangle stamps, free stamp magazine, stamps from Fighting Free French, 25 stamps from 25 different United Nation countries, pictorials, airmails, big bargain 5c with approvals. Capital Stam t, Dept. 2, Little Rock, Ark.

FREE French Madagascar set, new Ceylon war print, 3c with approvals. Superior, 1019 Greyton, Cleveland Heights, O.

GIVEN! Collection valued at \$2.00 including Czechoslovakia semipostal set, airmail, U. S. \$1.00, \$2.00, \$5.00, newspaper, Tannou Touva, ships, maps, animals, and many others to approval applicants—5c. Baldwin Stamps, Haworth, N. J.

VALUE Plus—U. S. exhibition sheet, telegraph stamp almost 60 years old, 25 more different U. S. Only 10c to new applicants for my U. S. approvals. Steger, 1165 Downing, Denver, Colorado.

TOP Prices paid for stamp collections. Lewis, 22 Liberty Street, Poughkeepsie, N. Y.

LIQUIDATING — Approval remnants, sets, packets—500 mixed \$1.00. Beacon Sales, Maynard, Mass.

STAMP Dividends. Details with approvals. Armstrong, 40 Jeanette, Youngstown, Ohio.

200 DIFFERENT Foreign, 30c. Many countries. Jem Stamps, Fort Jefferson, N. Y.

BARGAINS In fine approvals! Write today! International Stamp Co., Hallettsville, Texas.

U. S. Mixture, 5 lbs. \$1.75. Postage extra. U. S. price list. Stanley Gibbons, 38-P Park Row, New York.

FREE United States price list. Postage 3c. Mark Hanna, 335 - 5th Avenue, Pittsburgh, Penna.

HOW To start a stamp business and wholesale lists 3c. Shepard Service, 3780 Merchandise Mart Station, Chicago.

FREE! Western Hemisphere packet. Postage 3c. Owens, 806 Welsh, Bay City, Michigan.

OUTSTANDING U. S. values. List free. Ewing, 109 N. Dearborn, Chicago (2).

FREE! Pony Express set (facsimiles). Postage 3c. Roberts, 406 Building, Bay City, Michigan.

FREE! British Empire packet. Postage 3c. Williams, 606 Archer, Bay City, Mich.

STAMPS From 57 countries—10c. Approvals. Liberty Stamp Co., Kirkwood 22, Missouri.

FREE Your choice of any 10 stamps from our first U. S. approval selection. Illustrated list included. Cosmopolitan Stamp Company, Dept. 6M, 1457 Broadway, New York City.

WOW! \$10.00 Worth of fun for only 10c! 500 foreign stamps, unsorted and unpicked (mostly on bits of paper) just as received from the church missions and other sources. Africa, So. America, Australia, China, Philippines, Dutch Indies, and other countries are represented. Includes a few commemoratives, airmails, and stamps cataloging up to 25c or more each! The biggest package of fun in stampdom—and you might find something really valuable! Price only 10c to serious approval applicants! Money back if not delighted. Jamestown Stamp Co., Dept. No. 22, Jamestown, New York.

BRITISH Colonies 100 different 25c, 200 different 50c, 300 different \$1.25, 500 different \$3.00. Free list. Jean Husak, 1408 W. Genesee, Syracuse, N. Y.

118 DIFFERENT Stamps including commemoratives, charities, airmail, sets, etc. 3c with approvals. We buy stamp collections. Badger Stamp Co., Milwaukee P-3, Wisconsin.

PENNY Approvals, that satisfy. Neil Gronberg, Box 5441-P, Philadelphia 43, Penna.

1000 MIXED U. S. old and new 25c, 2 lb. \$1.00. Weatherby, Troy, Ohio.

19th CENTURY U. S. commems. Civil War revenues, battleship \$5 and \$10 stamps free to U. S. approval applicants. Metropolitan Stamps, 198-C Broadway, New York.

A \$2.00 Stamp plus 50 different, 3c with approvals. Knopp, Box 1381, Bristol, Conn.

FREE! Canadian sets, royal visit, George VI, George V, coronation, jubilee, others, to approval applicants. Ensign, Box 118-M, South Orange, N. J.

65 DIFFERENT United States 5c with approvals. Bookman, Box 145-M, Maplewood, N. J.

SOLOMON Islands, Seychelles, Neld, Caymans, Manchukuo, Brunel. Everything 3c with approvals. Viking, 130 (2) Clinton St., Brooklyn, N. Y.

WEEKLY Stamp Magazine, 26 weeks, 25c. Stamp Journal, Kalamazoo, Mich.

STAMPS, Superb selection sent on approval, attractive prices. Fred Herzberg, 168 Oak, Elmhurst, Ill.

CANADA 100 Different 25c—approvals all countries. Lists. Victoria Stamp Co., London, 4, Canada.

FREE! The Stamp Finder! Send today for the big new edition, fully illustrated, enabling you instantly to identify all difficult stamps! Also fine packet strange, fascinating stamps from Bosnia-Herzegovina, Monaco, Padua, Cyprus, etc., including maps, ships, animals and strange scenes. All free to approval applicants including 3c postage. Garcelon Stamp Company, Box 900, Calais, Maine.

SMOKY Mountain commemorative sheet, largest U. S. stamp issued, and 33 U. S. including commemoratives, airmail, revenues, etc. Catalogs 75c—To approval applicants for 5c. Curhan Stamp Company, Gloucester, Mass.

FREE! Leeward Is., Cayman Is., Turks and Caicos plus 60 different mint Geo. VI coronation poster stamps, to approval service applicants sending 3c postage. Tatham Stampco, Springfield-30, Mass.

500 UNITED States for 10c! 500 U. S. A.—absolutely unpicked and unsorted—just as received from church missions. Many varieties, including commemoratives, airmails, high values up to \$5.00 denomination! Price only 10c to approval applicants! Money back if not delighted. Swan Stamp Co., Dept. 65B, Dunkirk, N. Y.

FREE! Complete "United States" stamp catalog with 1,000 illustrations! Send 3c for postage. Harris & Co., 137 Transit Building, Boston, Mass.

VICTORY Packet free—Includes stamps from Tanganyika, British Cayman Islands, animal, scarce babyhead, coronation, early Victorian, airmail, map stamps, with big catalogue—all free. Send 5c for postage. Gray Stamp Company, Dept. PM, Toronto, Canada.

MEXICO Census commemorative set free with approvals. Pladon Stamps, 1717-M Idaho, Toledo, Ohio.

WHOLESALE Supplements to dealers for 10c postage. Hundreds of bargains. Grossman Stamps, 102 West 42nd, New York.

UNITED States approvals complete coverage, fine quality, attractive prices. Seminole Stamps, Box 436, Coconut Grove, Florida.

ONE And two cent approvals. South America, colonials, Europe. Scotty Stamp Co., 627 W. 339th St., New York, N. Y.

2-CENT Washington, Scherneck perforation, postage. Approvals. Gobrecht, 205 Anderson, Joliet, Ill.

COINS, TOKENS, CURRENCY

U. S. Coin packets, \$1.00 each: Two half cents; five large cents; three flying eagle cents; fifty Indian cents; five 2-cent pieces; five 3-cent pieces; four half dimes; one 20-cent piece; two quarters before 1860; half dollar before 1840; six Civil War tokens. Special, all eleven for \$10. Ben's Coin Company, 72 West Washington, Chicago 2, Illinois.

COMPLETE Catalogue of all U. S. coins 1/2c to \$1.00. 75 illustrations, 3500 quotations. Price 10c. James Randall, 341 South Dearborn, Chicago.

50,000 COINS, Medals, papermoney. Lists free. Nagy, 8 South 18th, Philadelphia 3, Penna.

COMMEMORATIVE \$1 1/2 — Texas, Kentucky, York, Elgin, Cleveland, \$1.50 ea. Illustrated catalogue 10c. Norman Shultz, Salt Lake City, Utah.

144 MILLION Dollars, prewar value—20 different foreign paper money from Russia, Poland, Austria, Hungary, etc. Really fine buy \$1.00. All-Nation, 157M West Lake, Chicago 1, Ill.

SAN FRANCISCO Mint Lincoln cents, 10 different 25c, 10 different Indians 25c, new silver dollar \$1.50. Big illustrated coin book 50c. 1943-S silver nickel and quarter 50c. Coin Shop, Box 77, Alameda, Calif.

OLD Money wanted. Do you know that coin collectors pay up to \$100.00 for certain U. S. cents? And high premiums for all rare coins? We buy all kinds. Send 4c for large coin folder. May mean much profit to you. Numismatic Co., Dept. 20, Fort Worth, Texas.

WE Buy Indian cents, Lincoln cents. Old rare coins wanted. Highest prices paid. Send 10c today for new 1943 price catalogue of all U. S. coins. American Rare Coin Co., Dept. 1, Transportation Bldg., Chicago.

FIVE Foreign bills 25c. Twenty-five different \$1.00. Beffel, Box 37-B, Ottawa, Illinois.

FREE! Foreign coin, banknote and coin collectors illustrated catalog to approval service applicants. Send 3c postage. Tatham Coinco, Springfield-125, Mass.

I MAY Have just the scarce U. S. coins you want. Send me list. "Meet me by mail." William H. Kenworthy, Waterville, Maine.

10 INDIAN Head cents, different dates, also price lists, 35c. Schultz, 1053 Richmond, Cincinnati, Ohio.

GET Profit and pleasure in collecting old coins. Send 10c for 56-page illustrated coin catalog. You'll be delighted with it. Send for it now. B. Max Mehl, 370 Mehl Building, Fort Worth, Texas. Largest rare coin establishment in U. S. Established 43 years.

HOBBIES AND COLLECTIONS

"MATCH Covers"—Each different—100 unused \$1.15. New and used 75c. Full books \$1.40. "Service"—Regular size 5c each. Royal Flash 10c each. Florida view cards \$1.25 per 100. Jimmy A. Mattox, 412 W. Sixth St., Jacksonville 6, Fla.

24 BEAUTIFUL Identified ore specimens, display carton, \$1.00. Arizona Mineral Specimen Co., Cherry, Arizona.

HOBBY Catalogue 5c stamp—coin list 3c, framed Mexican feather picture \$1.00, chameleon 25c. Quivira Specialties, Winfield, Kansas.

JOIN Insignia Collectors Club. Free, emblems and names of members, details for stamps. Hobbyguild, 35-K West 32nd Street, New York.

WORLD-WIDE Hobby membership blank, 3c. Falbaum, 170 S-Sunnyslope, Pasadena 8, California.

NEW—15 Different match covers 10c. Box 202, Rochester 1, N. Y.

NEW Gland stimulating vitamin. Details accompany "Colchicine" offer. See "Chemistry."

MATCHBOOK Hobby "Bulletin" membership blank free. Box 1111, Rochester 3, N. Y.

BEAUTIFUL Stones removed from rings, etc. 100 assorted \$2.00. Lowe's, Box 311, St. Louis, Mo.

UNUSED Match book covers, 100 all different \$1.00. 35 Royal Flash covers \$1.00. Free list. Charles Edelman, 1311C East 84, Cleveland, Ohio.

JOIN Matchbook club, 25c. Free covers. Box 101-B, Rochester 1, N. Y.

CAMERAS, PHOTO SUPPLIES

WE Pay top prices for used cameras and photographic equipment. Turn your idle camera, enlarger, printer, lenses, developing equipment, etc., into cash. Just send us a list of what you have. State make, model, age, condition. We will write you at once, telling you what we'll pay. Prepare your list today. Send to Central Camera Co., (Photographic Headquarters since 1899), 230 S. Wabash Ave., Dept. K162, Chicago, Illinois.

WE Pay peak prices for cameras, lenses, movie cameras, movie projectors, movie lenses, binoculars. Sell your photographic equipment now! Write giving full particulars and condition or send in via railway express collect for free estimate or C.O.D. with privilege of inspection. Armacam Camera Co., Dept. M, 1 East 43rd St., New York 17, N. Y.

LENSES — New but edges slightly chipped. For copying, ultra-close-up shots, magnifying, experimental optics, portraits of babies, pets, making telephoto lens, Kodachrome and stereoscopic viewers, ground glass and enlarging focusing aids, dummy camera, powerful telescopes, photo cells, rifle scopes and many other uses. Set No. 201-H "Our Advertising Special" 15 lenses for \$1.50. Set 209-H "The Gadgets of Delight" 35 lenses for \$5.00. Set No. 210-H "The Experimenter's Dream" 70 lenses for \$10.00. All sets postpaid with big ten-page booklet of plans and directions. Satisfaction guaranteed. Edmund Salvage Company, 41 W. Clinton Ave., P.O. Audubon, N. J.

MAKE Money in photography. Learn quickly at home. Easy plan. Previous experience unnecessary. Common school education sufficient. Booklet and requirements free. American School of Photography, 1315 Michigan, Dept. 3431, Chicago.

OIL Coloring photographs a fascinating hobby or profitable business. Learn at home. Easy simplified method. Previous experience unnecessary. Send for free information and requirements. National Art School, 1315 Michigan, Dept. 344B, Chicago.

BASS Says: War time proves Bass leadership. Amazing selection of finest still cameras—Leica, Contax, Korelle reflex. Argus, new and used still available. Write for quotations. Satisfaction guaranteed or your money refunded. Bass buys 'em, sells 'em, trades 'em. Bass Camera Company, Dept. AC, 179 W. Madison St., Chicago, Illinois.

HAVE You a camera? Send ten cents for recent number of our big magazine, showing how to make better pictures and earn money. American Photography, 110 Camera House, Boston, Mass.

CASH! Spot cash for cameras, lenses, binoculars, movie or still, sound projectors. Send full description by mail, or wire for prompt cash offer. Over 30 years of dependability insures honorable dealings. Bass Camera Company, 179 West Madison Street, Chicago, Illinois.

PHOTO FINISHING

ROLL Developed, photo album, 2 enlargements, 8 prints 25c. Geppert Studios, Dept. 1-1, Des Moines, Iowa.

FILM Developed, 8 album size enlargements or 16 sparkling prints, 25c; 8 snapshot 4x6 enlargements, 30c. Reprints, each: Contact prints, 2c; album enlargements, 3c; 4x6 enlargements, 4c. Crystal Studios, 150-F, Rushford, Minn.

FREE: Have your 35mm. film developed by specialist. First film done free! Film fine-grain developed, 36 big, sparkling, never-fade, 5x7 enlargements—only \$1.76! 3½x5—\$1.00, 18 exposure—75c. Satisfaction guaranteed! Overnight service. Free mailers, price list! MiniStudio, Department 1-B, 2421 Seneca, Westfield, N. J.

16 SPARKLING Lifetone prints, 2 beautiful Hollywood enlargements, free Leatherette frame and photo wallet only 25c. Free photo album with first order. Lifetone Studios, Dept. A-1139, Des Moines, Iowa.

FREE Photo Christmas card! Send negative today for free card, amazing bargain offers, Mosher Studios, Vineyard Haven, Mass.

COLOR—It's easy to color photographs with transparent oils. For pleasure or profit. Book gives full instructions. Price \$1.00. Currie, 45A Cherry St., Quincy, Mass.

6-8 EXPOSURE Rolls developed and enlarged mammoth size 30c. Reprints 3c. Thrifty Photos, Box 46, South Gate, Calif.

5x7 ENLARGEMENTS, 15c; ten for \$1.00 cash or C.O.D. Send negatives, DeVane's Studio, Melville, La.

YOUR Favorite kodak pictures enlarged, size 5x7, 10c; three for quarter, coin. Send best negatives (film) today. Address Geppert Studios, Dept. A-1, Des Moines, Iowa.

EIGHT 8x10" Enlargements \$1.00. Three for 50c, 20c each. Ten 5x7" double weight enlargements \$1.00. Four 50c. Either size oil colored 25c each extra. Snapshots copied 25c. Empire Photos, Adams Center, N. Y.

EMBOSSED Christmas cards including envelopes from your own negative, 25 for \$1.25, 12 for 75c. Samples—4 for 25c from one negative. Film Capital Service, 840 Dewey Ave., Rochester, New York.

SPECIAL Offer. Hand colored 5"x7" photo enlargement on professional double weight paper from film or photo, costs you only 25c. 16 case! frame desired add 10c. No extra charges. Include color hair, eyes, etc. Send only coin or money order, Dept. V, Box 151, Station D, New York City.

XMAS Cards from own negatives 65c dozen. Send negative for sample. Films developed and 16 prints or 8 prints and 2 enlargements 25c. Crystal Photo Service, Box L, Crystal Lake, Ill.

ROLL Developed, printed, enlargement coupon, 20c, trial. Reprints 2c. Modern, 1400 So. Seventh, Maywood, Ill.

BIGGEST \$1.00 Value in 35 mm. finishing today. 36 exposure fine grain 3½x4½ enlargements; deckled, embossed margin and date. Eighteen exposures 75c; sixteen exposure splits 55c. Free mailers. 8 exposure rolls in beautiful deckled contact finish with embossed wide margin. 25c. Mailbag Film Service, Box 5440A, Chicago 80.

INTRODUCTORY Offer—Six enlargements from your favorite negative, 25c. Skyland Studios, Box 411, Dept. "EM", Asheville, N. C.

QUALITY Photostamps from any snapshots \$1.00 per hundred. Specialist, 82-29 60th Road, Elmhurst, New York.

VELOX Deckle reprints 2c. Rolls developed, two deckle edged prints each negative, 25c. Two 5x7 enlargements 25c. Summers Studio, Unionville, Mo.

FILMS Scientifically developed plus 8 beautiful 4x6 enlargements, 30c complete. Photo-Service, 107 Dewey St., Newark, N. J.

8 BEAUTIFUL Enlarged prints (nearly postcard size) or 16 regular prints 25c. 35mm. rolls enlarged 3½x4½, \$1.00. Burton Studios, 55-M, Roscoe, New York.

OIL Coloring photographs a fascinating hobby or profitable business. Learn at home. Easy simplified method. Previous experience unnecessary. Send for free information and requirements. National Art School, 1315 Michigan, Dept. 343B, Chicago.

IMMEDIATE Service! Pictures returned same day order received. Smashing low pre-war prices! Sixteen guaranteed deckle-edge Velox prints from roll, 25c. Or one colored or two plain enlargements free with 8 deckle-edge prints, 25c. 16 reprints from negatives 25c. Candid rolls developed. Magic-Eye timed, vaporated, and enlarged to 3x4 on deckle-edge Velox paper—36 exp. 35mm. \$1.00; 18 exp. 60c; 16 exp. No. 127, 50c; 8 exp. Bantam, 25c. Reprints, 3x4, 3c each. We have new, perfect 35mm. film! Low prices. Free mailers, details on request. American Studios, Dept. 606, LaCrosse, Wis.

BEAUTIFUL 4x6 Pictures 3½c each, from 116 and 120 negatives. 3½x4½ from all other sizes. All work guaranteed. Overnight service. Roll developed and 8 pictures 30c. Roll 12 pictures 45c. Roll 16 pictures 60c. Enlargements on double weight portrait paper 5x7—30c, 8x10—50c. Copies made from any picture 75c. Pacific Photo Service, Box 660, San Francisco, Calif.

THREE Prints each good negative, 6 to 8 exposure rolls, 30c. 12, 16, 18 exposure rolls, 50c. Reprints, 3c. Fred D. Eastman, Bode, Iowa.

8x10 SILK Finish enlargement—25c. Send negative. Irving Studio, 4006A Irving Park, Chicago.

EVERY Picture an enlargement! 8 sparkling deckle-edge enlargements and roll developed 25c coin; 116 size or smaller; enlarge reprints 3c. Enlarge Photo, Box 791D, Boston, Mass.

BEAUTIFUL Enlargement from each picture on roll 25c. Cut Rate Photos, Dept. B-4, Janesville, Wis.

PHOTOGRAPHY For pleasure and profit. Prepare at home. Common school education sufficient. Write for information and requirements. American School of Photography, 1315 Michigan, Dept. 3452, Chicago.

MOTION PICTURES AND SOUND EQUIPMENT

MOVIES: Travel, comedy, glamor. 8mm-16mm. Lists free, with glamor sample, ten cents. Keeley, 42-M, West Market St., Corning, N. Y.

100' 16MM. Used sound film. \$1.00 postpaid. Write for list of complete subjects. Blackhawk Films, Dept. PM7, Davenport, Iowa.

8-16MM. Film-subjects. Black and white and color; sound or silent. Largest selection ever compiled; 75c to \$100. Write for new, deluxe catalog—profusely illustrated! 25c (coin or stamp) refunded first purchase. Hollywood Movie Supply, Hollywood, California.

8MM. And 16mm. films exchanged. Box B-49 2209 Main Street, Bridgeport, Conn.

\$1 BRINGS "Surprise" assortment 8mm. colorful titles! Guaranteed. LeMoine Films, Nevada, Missouri.

INVASION Of Sicily, comics, westerns, dramas, 8 and 16mm. 3c stamp. Excel Home Movies, 634 Acklin, Toledo 10, Ohio.

8MM-16MM. Films list, free. Magna's, 536 River, Paterson, N. J.

PANCHROMATIC 16mm. Film \$3.95 100 ft. Victor sound projector model 40-B. Genera Co., Davenport, Iowa.

GLAMOUR Newsreel No. 4, Majorettes and beauty queens. 50 ft., 8mm., regularly \$2.00, only \$1.00, 16mm., 100 ft. \$2.50. Lists, sample, dime. Jenkins, 392-F, Elmira, N. Y.

35MM. Sound features! Shorts! Technicolor samples 10c. Demsey, 1613 Stewart, Youngstown, Ohio.

DEALERS 16mm. Films. Sample. Catalogue, dime (refunded first purchase). Paramount, 2331 Ripley, Davenport, Iowa.

8MM., 16MM. Rentals, silent 40c per reel; sound features \$4.95. Free lists, National Cinema, 71 Day St., New York.

NEW Movie films—cheap! Lists free! Phipps, 311 Gay, Phoenixville, Penna.

1000 8-16MM. Films. Sensational reductions. Catalogs free. Bargain Films, 719-E 61st Street, Los Angeles, California.

35MM., 16MM. Sound silent projectors, films. Savarese, Woodcliff Lake, N. J.

SEND Stamp for 16mm., 8mm. catalogue. Sterling's, 679 Northampton, Easton, Pennsylvania.

"ALL-AROUND" Reflector Co. guarantees their reflector will give 25% more screen illumination on Revere projectors. Address, 10111 Euclid, Cleveland, Ohio.

8-16 FILM Subjects, \$1.55 up. List, stamp. Pence Service, 2484 Liddesdale, Detroit, Michigan.

FREE Movie film catalog; sample 10c. Goodwill Company, Jackson, Tennessee.

"THE World's Greatest Passion Play." 8mm, 16mm, and 35mm. Specify silent or sound. Rent or purchase, include stamp. Hemenway Film Co., 33-F Melrose St., Boston 11, Mass.

MOVIE Film, 100' 16mm. \$1.00—25' double 8mm. \$1.25, developing included. Ambassador, 479-A Quincy Street, Brooklyn, N. Y.

MOVIE Projectors. Bought and sold. United, 2309 Lawrence, Toledo, Ohio.

GUARANTEED Fresh 8mm film, \$2.60 six spools Univex Eso-B, \$3.45 three spools double 8mm. Delite loading. Will ship C.O.D. Catalog, Eso-S, 3945 Central, Kansas City 2, Missouri.

NEW Movie films—Low prices! Direct from laboratory. Free list! Bergen Films, Lodi, N. J.

ALL Makes camera films, 100 ft. 16mm. \$2.00, 8mm. 25 ft. double \$1.25. Developing free. Also complete movie subjects available. Free catalog, Star Safety Film, 630 - 9th Ave., New York.

LEARN Movie projection, management. Free catalog. Give age. Theatre Institute, Elmira, N. Y.

BASS Says: Leadership in the cine field is apparent in war times. Here ready-made choice of 8 mm. and 16 mm. apparatus. Write for quotations. Your old equipment is worth real money in trade—describe please. Or we buy for cash and pay immediately on receipt. Write to headquarters. Bass buys 'em, sells 'em, trades 'em. Satisfaction guaranteed or your money refunded. Bass Camera Company, Dept. A, 179 W. Madison St., Chicago, Illinois.

MUSIC AND MUSICAL INSTRUMENTS

PIANISTS—Quickly improve playing, technique, sightreading, accuracy, memorizing through mental-muscular co-ordination. Free booklet. Broadwell Studios, Dept. 43K, Covina, Calif.

SONGWRITERS! Amazing, outstanding proposition. Hibbler, C5, 2157 N. Avers, Chicago.

POEMS Wanted for musical setting. Send poem for immediate consideration. Five Star Music Masters, 630 Beacon Building, Boston.

SONGS Wanted. No advance charges. National Songwriters, Music Publishers, Box 1647E, Hollywood.

SONGWRITERS! Astounding proposition! Particulars free. Professionals, Box 339, Mill Valley, Calif.

MUSIC Composed to words. Wonderful proposition. Bauer Bros., Oshkosh, Wis.

SONGWRITERS! Send your poems for our offer and free "Rhyming Dictionary." Phonograph records made. Vanderbilt Music Studios, Box 112, Dept. 2-L, Coney Island, N. Y.

POEMS (Songs) music—arranged, recorded, printing, pay-go plan. Free diagnosis. Tune Doctor, G.P.O. Box 551, New York 1.

GOOD Music composed to good words. Music printing. Reginald Belcher, Chatham, New Jersey. Established 1910.

TONEPOST Perfects artists' violins. Dollar. Information, dime! Patmor, Zion, Illinois.

ACCORDIONS \$69.50. Buy and sell. All makes. 60% discount. Request catalog, 43 N. Albany, Chicago.

PLAY Hit songs swing-piano style! Send dime for sample arrangements, home-study folder. Christensen Studios, 751 Kimball Hall, Chicago 4, Ill.

SONG Poems wanted. Free examination. McNeil, Master of Music, 610-PM South Alexandria, Los Angeles, Calif.

BEFORE Sending your poem to be set to music "know your composer." Free booklet. Al Moquin, 2110 Beachwood Dr., Hollywood 28, Calif.

ACCORDIONS: New and used, bought, sold and repaired at wholesale prices. Cash and terms. New 90 page accordion method \$2.50. Del Principe, 307 So. Wabash, Chicago.

OUTSTANDING Songwriting service. Roscoe Barnhart, 1320 48th, Des Moines, Iowa.

SONGWRITERS—Write today. Free booklet, plan. Song Service, 331-C West 46th, New York.

SONGWRITERS—Free book, send poems. Variety, Dept. 2, Salem, Indiana.

WANTED! Lyrics, melodies for songs. We arrange, publish, sell. Superior Song Studios, Passaic, N. J.

SONGWRITERS—Send poem for immediate examination and free rhyming dictionary. Richard Brothers, 24 Woods Building, Chicago.

SONG POEMS wanted: Write for free instructive booklet, outlining opportunities. United Music Corporation, Dept. 14, Salem, Indiana.

SONGWRITERS, Write for free booklet, profit sharing plan. Allied Music, 204 East Fourth, Cincinnati, Ohio.

WRITE SONGS. Big money and reputation. Write for information. J. Gordon Pub. Co., 201 N. Hoyne Ave., Chicago.

RADIOS, SUPPLIES, INSTRUCTION

MIRACLE Point \$1 phonograph needle plays 2000 records, plus money-saving parts and tube catalog all for 25c. Radio Warehouse, 383 Wooster, Akron, Ohio.

CRYSTAL Radio experimenters. Write Hulet, 29 East 39th St., New York.

REVISED Plans 18 long distance crystal sets, with "Radiobuilder"—25c. Laboratories, 1406-C 77th Avenue, Oakland, 3, California.

LOWEST Prices. Radio tubes, parts. Free bargain lists. Potter, 1314-P McGee, Kansas City 6, Mo.

PREPARE Yourself now for a well paying radio position after the war. Obtain your FCC commercial radiotelephone and telegraph licenses through our home study courses, written for the man who has forgotten higher mathematics. An easily read, easily understood course. Moderate tuition fee. Write for particulars. American Radio Institute, 44 East 23rd Street, New York, N. Y.

RADIO Service men and experimenters send for our giant radio catalogue. Save dollars. United Radio Co. (1000M), Newark, N. J.

BUSINESS OPPORTUNITIES

MECHANICALLY Inclined men—Own and operate general appliance repair shop. Complete, illustrated course shows you how. Welding, refrigeration, motor repair, how to get business, etc., all phases covered. Free literature. Christy Supply Dept. 134, 2835 N. Central Ave., Chicago.

START Home business making statuary, plaques, art goods, novelties, souvenirs, concrete pottery, garden furniture, artificial marble flooring, liquid marble. Make your own flexible molds. Amazing profits. Valuable folder free. Creative Publishers, (PM11), Glencoe, Illinois.

SELL Books by mail, deal direct with publishers. Complete plan dime. Dixie Sales, King, N. Car.

OPPORTUNITY—For real cash instead of promises. Request literature immediately 10c. Arthur Broekner, Box 1207, Woodhaven, N. Y.

37 RED Hot, up-to-the-minute, guaranteed, local and mailorder, small capital, money-makers with magazine lamb full of information 10c. "Leaders," 319 So. Marengo, Pasadena 5, California.

START Spare time home business. Information free. 100 big mails 50 cents. Morey Enterprises, North Chicago, Illinois.

START Local or mail order business. Write Dunn's, Dellslow, W. Va.

BIG Money. Make wooden baby walkers. Plans 50c. Chester Company, 3719-A 28th, San Diego, California.

CO-PUBLISH Magazine. Big profits. Sample ten cents. Journal, Ragan, Nebr.

LIFETIME Business, home, office; particulars describing "300 Business Plans" free. Russell, 912-A Anniston, Sylacauga, Alabama.

PAYING Mail business—Stamp brings proof. General Publications, Ossining, N. Y.

BRAND New book—68 pages, 40,000 words—All real money-makers, business secrets, successful mailorder plans, wholesale supply sources—25c. Moneyback guarantee. Smith Publications, 213 Comstock, Syracuse, N. Y.

THOUSANDS Of articles wholesale. "Supply Source Directory" 10c. Ideal Service, D-11, Park Ridge, Ill.

MAKE Big money—spare time or full time. Operate from home, or office. Experience unnecessary. Details free. Goddard, 916 Kelly Street, New York.

TOOL Designing pays big. Home study course. Low cost. Easy terms. Free booklet. Ohio Institute of Technology, Box 122, Greenville, Ohio.

OPPORTUNITIES Galore: New, fascinating, variety home-work earns big money. Dime brings three distinct money-making magazines, catalog, details. Billings, 705 Railway Exchange Bldg., Montreal, Canada.

HUSTLER Wanted! to introduce, supply demand for Rawleigh necessities. Good routes open nearby. Rawleigh methods get business. No selling experience needed to start. We supply sales, advertising literature—all you need. Profits should increase every month. Low prices; good values; complete service. Rawleigh Co., Dept. K-83-PPM, Freeport, Ill.

QUICKEST, Cheapest, shortest way to learn the mailorder business. 4,500 word folio 25c. Hoffmann, 2740 Cox, Cincinnati 19, Ohio.

PLASTEX Statuary and novelties—If you wish to start in a paying manufacturing business of your own we can help you get started right as we have the experience being the largest producers. If you are a manufacturer either on small scale or for big production we are ready to buy for cash any quantity of plaques, statuettes, book-ends, murals, novelties in Marbleite Plasteer or Plastic of any kind, if suitable and at the right price. Particulars free without obligation. W. R. Cote, 14 Wellwood Ave., Toronto, Canada.

BUILD Your own business in spare time. Details of many plans, books, 10c. Excellent 25c plan included free. Nelsen, Box 217-A, Hicksville, N. Y.

OPEN Cutrate drugstore by mail. Complete plan dime. Dixie Service, King, N. Carolina.

BEGINNERS Mail order and local business plans and formulas. Five 25c books for \$1.00 postpaid. Circulars free. Brain's Book Shop, 118 Washington Ave., Endicott, N. Y.

GET Into mail selling. Prepare for future. Start sideline business now. Splendid opportunities. Interesting, profitable propositions immediately available. Progressive Magazine tells how! Free details and premium offer. Sheboygan Publishing Co., Sheboygan, Wisconsin.

START Your own magazine agency at home. No capital required. Write for particulars and supplies. American Readers' Service, Hatfield, Penna.

"HOW To Make Simple Molds and Plaster Plaques." Profit in popular novelties! Booklet 25c. Plastercraft, 1406 E. 43rd St., Cleveland, Ohio.

MAIL Order magazines and giant mail 10c. Kratzer, 143 So. Sedgwick, Wichita, Kansas.

MOLDMAKING—Plaster Casting. Complete formulas—fully illustrated. 25c. Ideal Service, RM-11, Park Ridge, Ill.

YOU Too can learn how to make mold and cast real plastics. Send stamped envelope. Box 498, Gainesville, Texas.

NEW York branch office under your name, will increase your business no matter what your proposition is. Rent—\$1.00 monthly, \$7.30 yearly. Co-operative Offices, 126 Lexington Avenue, New York.

MAILORDER Opportunities book, large size, 10c. Waddell's, 309 East 75th, New York 21.

MAKE Money mailing our postcards. Sample article. Instructions 25c. Others, 57 Nugent, New Hyde Park, N. Y.

SIGNS And showcards easily and expertly painted with letter patterns. Many sizes and styles. Write for descriptive folder. John Rahn, A1330 Central Ave., Chicago 51.

FREE Subscription to "The Mail Order News" (Somerville, N. J.) Oldest mail trade journal in America. Offer limited. Drop postal today.

RAISE Guinea pigs at home. Millions used, markets everywhere. Booklet free. Taylors Guinea Pig Farm, Haverhill, Ga.

MAKE Money at home in spare time by mail, start with as little as \$2 or \$3. Particulars free. Kraft Publications, 112 Madison, Aurora, Missouri.

WINTER Is coming. Make your own anti-freeze. Nine formulas \$1.00. Box 177, Gainesville, Texas.

PAINT Signs for profit with aid of lettering patterns. Free literature. Sample alphabet 10c. Display Letters Co., Box 28, Ft. Hamilton Sta., Brooklyn 9, N. Y.

HOMEWORKERS—Manufacture gifts, plaques, novelties; 90% profit. Material, molds, instructions furnished. Sample large scottie mold model, door stop, savings bank, radio ornament, with illustrated molding circular, catalogue hundred new flexible molds \$1.00 postpaid. Plastic Products, 1410W Belmont, Chicago.

300 WAYS To make extra money: Tested and guaranteed. 25c coin. Business Mart, 253-B Plymouth Bldg., Minneapolis, Minn.

MEN, Here's opportunity. Send 50c. Receive best money making formula of all waterless hand soap and paint cleaner. Warron Chemical Co., 5438 N. W. 3 Ave., Miami, Fla.

MAGIC Races—At cigarette touch six horses are off. Fast seller. Big profits. 6 races and quantity prices. 25c coin. Greene, 4216 Redwood, Venice, Calif.

LIBRARY Business opportunities mail order information free. Clark System, Ellwood City, Penna.

EXTRA Income—Plenty mail selling opportunities. Write Katz, 4254 N. Kimball, Chicago.

START A home business in spare time. Make extra money. Experience not essential. Literature free. H. H. Schultz, RFD 2, Box 9-A, Pascagoula, Miss.

COLOR Cement with chemicals. Make artistic cement garden ornaments Hollywood style. Sample 10c. Hollywood Cementrat, 8527 Wonderland, Hollywood, 46, Calif.

SUCCESS Says hello to you! Your own boss, your own business, right at home! Amazing new mail order course shows you, tiny capital quickly starts you. Thrilling literature free. Century, P.O. Box 282, Naugatuck, Conn.

KARAKUL Sheep are profitable. Write: Addis A. Kelley, Maywood, California.

PERFUMERS Make big, quick and steady money. I furnish complete detailed instructions. Don't delay. Write Dr. Abell, Parkway Bldg., Pasadena, Calif.

DISTRIBUTE Vitamins, minerals, health books. Wholesale prices. National Diet Company, Portland, Oregon.

CHARTERS: Delaware; best, cheapest; free forms. Colonial Charter Co., Wilmington, Del.

MAKE Money at home in spare time by mail. Write Gordon Publishers, Box 23, Pawtucket, R. I.

MAIL Order business course shows you how to make money, spare or fulltime. Teaches professional mail order technique—not penny-catching schemes. Free details. Nelson Co., 321 South Wabash, Dept. 402, Chicago.

DRUNKENNESS Is a disease which responds to treatment. Medical skill plus human sympathy prove successful with liquor and drug cases. 60 years experience. Write for free booklet. P. M. Nelson, The Keeley Institute, Dwight, Ill.

AGENTS—To mail our literature. Good profits. Home business. Maywood, 1133 Broadway, New York.

5 MOST Read mail order magazines 20c. Armand Cartier, 595A North, Pittsfield, Mass.

WEBER Typewriter Mechanics School. Simplified homestudy-repairing increasing. Canton, Ohio.

PLASTEX Industries offers industrious men an opportunity to start a business of their own, manufacturing art goods, novelties, souvenirs, etc., in Plastex and marble imitation. Se material makes \$1 articles. Rubber moulds furnished for speed production. Small investment brings good returns. We are now placing big chain store orders with manufacturers. Write for interesting booklet mailed free. Plastex Industries, Dept. A, 1085 Washington Ave., New York.

HOW And where to obtain capital. Fully explained, particulars free. Star Service, Waukegan, Ohio.

137 WAYS To make money, in home or office, business of your own. Full particulars free. Elite Co., 214 Grand St., New York.

LIQUID Marble—Colorful, glazed! Mold, brush, spray! Composition floors, rubber-lastic molds. Particulars free. Marbleizing Service, Edwardsville, Illinois.

BRUSH Plating outfits connect to a battery. No tanks necessary. Good paying business at home plating autoparts, bathroom fixtures, bicycles, reflectors, silvering mirrors. No shop or experience required. Outfits furnished. Free booklet. Gunmetal Co., Ave. H, Decatur, Ill.

LIQUID Marble; snow-white, multi-colored. Glazed. Unglazed. Composition flooring. Lifetime wear. Any color. No priorities. Flexible molds. Plaster casting. Get into the big money now. Full information given free. Write Compo-Tex, Box 786, St. Louis, Mo.

MONEYMAKING OPPORTUNITIES

HELP Win the war first! Then man, you'll like silvering mirrors, reflectors! Making sparkling chipped glass nameplates. Outfit prices. Sprinkle, Plater, V60, Marion, Indiana.

TURN Your sparetime into money. Progressive Mailtrade furnishes the ideas and information. Sample copy 10c. Victor Jones, Parma, Missouri.

WINNING \$-getting schemes, tips, opportunities, formulas; two copies, 10c. 45th year. Schemer Magazine, Alliance, Ohio.

MAKE Money at home in sparetime. Mailorder business is your opportunity. Start with as little as \$2.00. New—amazing system that works wonders, prepared by expert. Startling information free. Alfred Siddall, Atascadero, Calif.

PUBLISH Your own magazine. Handsome 52 page format, well edited, illustrated. Cost low as \$1.00 month. Brings you prestige, profits. 10c brings sample, details. National, Ord, Nebr.

MECHANICALLY Inclined men — Own and operate general appliance repair shop. Complete, illustrated course shows you how. Welding, refrigeration, motor repair, how to get business, etc., all phases covered. Free literature. Christy Supply Dept. 1134, 2835 N. Central Ave., Chicago.

WHOLESALE Price list books and novelties free. Torian's, Hampton, Virginia.

PROFITABLE Homework. Particulars free. Woodcraft Projects, 1320 Lindsay, Gainesville, Texas.

CASH In on your ideas, stories, poems, etc. Magazine 25c. "Arrival," 319 So. Marengo, Pasadena 5, California.

MAKE Your own Flexible Molds. Statuary, Art Goods, Novelties, Artificial Marble Flooring, Liquid Marble. Literature free. Kemico, 11-M, Park Ridge, Ill.

MONEY? Spare time opportunities for stamp. Box 1348, Louisville, Ky.

BUILD Bank account, new courage and backbone, future success. Postal brings marvelous ideas. Shore Sales, 115 Atlantic, Matawan, N. J.

EARN Money evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle, Wisconsin.

BIG Paying profession, make and fit arch supports. Lowest priced instructions. Jul. Corssen, 3609 Texas Ave., St. Louis, Missouri.

SOLDIER Moulds for toys, illustrated catalog 5c. Henry Schiercke, Ghent, N. Y.

MAKE Money at home by mail. Jamesk, Box 1436, Long Beach, Calif.

MONEY In your own bedbug destroyers. 8 formulas 50c war stamps. J. E. McCray, 510 Tennessee Avenue, Avondale, Savannah, Georgia.

BOOKS Magazines, money making opportunities, 400 pages, 25c. Thomason, 857 East Jessamine, Fort Worth, Texas.

185 NAMES And addresses of mailorder magazines, ad sheets 25c. Hoffmann, 2740 Coy, Cincinnati 19, Ohio.

DOLLARS In your mail! Write for attractive proposition. Coleman's, Smithboro, N. Y.

DIMES! Quarters! Dollars! By mail! Latest plans! Your name listed permanently with over 100 firms—10c. Novel Enterprises, Dept. 3A, Box 457, Reno, Nev.

YOUR Name printed in 10,000 "Big Mail" directories, 25c. Checking copies sent. Arlesse's, 15881 Log Cabin, Detroit, Michigan.

SKETCH Your way to success—the simple way. Write to C. H. Taylor, Room 519C, 20 Worthington Street, Springfield, Mass.

"START A home business in spare time." Make extra money. Experience not essential. Literature stamp. Gofflot Service, Alhambra, Calif.

KNACK Of making money in any business, job or profession. No selling. Easily mastered. We show you how. Information free. Better Sales Co., P.O. Box 35, Sta. E, Cincinnati 19, Ohio.

TWELVE Small ads "that keep my mail business going" sent for 25c coin. Johnston, 605 McDonald, Lakeland, Fla.

GREATEST Success mail only one dime. Success Service, Norfolk, N. Y.

EXCELLENT Sparetime profits handling subscriptions—2500 magazines. Confidential catalogue. Starting supplies free. Pines Subscriptions, Flushing, N. Y.

MAGAZINE—300 Money-making opportunities, 25c. Arnold, Box 84, Forked River, N. J.

IF You want to swap-buy-sell anything, send for Swappers Guide. It's full of opportunities all over America. 20c copy. Free advertising. Swappers Guide, 610 N. St. Joseph, Evansville, Ind.

TURN Your sparetime into cash. Literature free. Pfeiffer & Jamison, P.O. Box 4866, Washington, D. C.

GIANT Mails 6c; Mail Sale Magazine 3c. Opportunity mail free. Harvey Teeple, (F.M.) Decatur, Indiana.

ADDED Income. Write diets, give counsel, analyze character through body chemistry. Outline of 19 types 10c. T. Gooley, 3910 N. Bell, Chicago.

MAIL Order business makes money! Plan for victory—now! Magazine, information 10c. Root, Box 343K, Rockford, Illinois.

LEARN Metascience. Remarkable drugless healing. No manipulation. No apparatus. Unbelievable simplicity and results. Inexpensive correspondence course. Write Metascience, De Land, Florida.

EARN Money at home! Thousands do! "Home Worker Magazine" tells how. Sample, 25c. Sizemore, Box 7, 4917 North Keothar, Chicago.

RECEIVE Mails, literatures, magazines. Send 10c. McPlastens, 216 S. Laflin, Chicago.

FORMULAS, PLANS, ETC.

MAKE Fast selling products. No machinery. "Chemist Approved Formulas." Literature free. Kemico, 15, Park Ridge, Illinois.

NORTH Pole anti-freeze, tops them all. Make your own 15c gallon. Guaranteed formula and instruction \$1.00. Diamond X Products, Box 213, Gabbs, Nevada.

600 SQUARE Inches luminous cloth, 12 fluorescent crayons, \$1.00. Franklin Miller, 18 - 39 St., Wilmington, Del.

"LUMINOUS Paint" shines in dark. Easily made. 100 other formulas, plans—all 25c. Soap-making course (20 formulas) \$1.00. Resilvering mirrors, formula 20c. Ideal Service, 311 Park Ridge, Ill.

110 FORMULAS And catalogue 25c. Curtis' Specialties, Box 1916, Denver, Colo.

FORMULA Athlete's foot. Special 25c. Viggiano, Chemist, 6556 Ladson, Pittsburgh, Penna.

FORMULAS, Analysis, free literature. Research, 330 Charles, Grand Rapids, Mich.

NEW Gland stimulating vitamin. Details accompany "Colchicine" offer. See "Chemistry."

LATEST Formula lists, free. Warren White, 1300 Commerce, Dallas (1), Texas.

REAL Manufacturing formulas. Lists free. Cummings, Chemist, Gordon Ave., Syracuse, N. Y.

FORMULAS—Latest, best. Analysis. Literature free. Belfort, Engineering Building, Chicago.

AUTHENTIC Formulary 924 pages (illustrated), 10,000 money making formulas, recipes, instructions, substitutes. \$2.00 postpaid or C.O.D. (foreign \$2.35). Catalog. Adams Brown Company, Chestnut Hill, Massachusetts.

CHEMISTRY

WINN'S New Idea Home Laboratory Chemical Kits and apparatus outfits for home experimenting. Send 5c for literature and retail supply catalogue. J. H. Winn Co., Dept. 511, 124 W. 23rd St., New York.

FREE Catalog: Chemistry, mineralogy, biology, optics. Tracey Laboratories, Evanston, Illinois.

FREE Chemical catalogue. Enclose 3c postage. Greenwood, 398 Broadway, New York.

HANDBOOK For chemical experimenters. Hundreds of experiments, illustrated. 50c. Experiment booklet 10c. Chemistry catalog 5c. Reading Scientific Company, Reading, Penna.

COLCHICINE—Evolution chemical creates new mutant plants. Illustrated booklet plus Experiments magazine 25c. Questok, Wellesley, Mass.

CHEMISTRY Laboratory apparatus and chemicals for industrial, analytical, and private experimental laboratories. Complete chemical laboratory supply service for correspondence school students. Send 3c for free 48-page catalog of chemicals and apparatus. Dept. M-43, Biological Supply Co., 1176 Mt. Hope Ave., Rochester, New York.

SPECTROSCOPE For quick chemical analysis \$2.50. Kutting Sons, Campbell, California.

AGENTS WANTED

CALL On friends with sensational personal Christmas cards—50 for \$1.00 up. Personal stationery. Also magnificent 21 card \$1.00 assortment. Profit 50c. Experience unnecessary. Samples on approval. Wallace Brown, 225 Fifth Ave., Dept. B-34, New York.

STRANGE "Dry" shoe polisher. Sells like wild. Replaces messy pastes, liquids. Simply glide over shoes. Samples sent on trial. Kristee, 129, Akron, Ohio.

START Your own business on our capital. Always your own boss. Hundreds average \$3,000 to \$5,000 annual sales year after year. We supply stocks, equipment on credit. 200 home necessities. Selling experience unnecessary to start. Wonderful opportunity to own pleasant, profitable business backed by world wide industry. Write Raleigh Co., Dept. K-U-PPM, Freeport, Ill.

AGENTS, Big line including food products. Fast selling premium and bargain deals. Low prices. Send card for big outfit offer with gift. Ho-Ro-Co, 2737 Dodier, St. Louis, Mo.

CHRISTMAS Card agents. We undersell everybody. Finest nationally known lines. Name imprinted. Also box assortments. Dime (refunded) brings beautiful samples. Klayer, 2219 Crane, Cincinnati, Ohio.

AUTO Cleaner. Costs 10c, sells \$1.00. Make it yourself. Free sample. Write Formico, 314 Klefner, B. Dayton, Ohio.

PLAYING Card game. 250% profit. Sample game 25c. Box 842, Denver 1, Colo.

LUMINOUS Paint (shines in dark). Spectacular dollar seller. Rush name for profitable details and free sample. Ward, 97C, Saybrook, Connecticut.

MAKE Extra profit handling magazine orders in your community. Easy sales, liberal commission. Big Christmas season ahead. Write for free wholesale catalog. McGregor Magazine Agency, Dept. PM11, Mount Morris, Ill.

SCHOOL Seniors—Sell America's most beautiful, distinctive graduation name cards. Positively highest commission. Lowest prices. Free sample kit. Printcraft, 1423 E. Elm Street, Scranton, Penna.

MAGIC Cleaner and laundry soap deal. Hotter than a firecracker. Big profit! Sample free. Bestco, 5007 Irving Park, Chicago.

BIG Bargains for big profits. Men's used pants 25c, suits \$1.50, overcoats 50c, shoes 12 1/2c. Over 100 sensational values. Experience unnecessary. Free wholesale catalog. Superior, 1250-KD Jefferson, Chicago.

BELT Sample 25c, prices 3c. Leathercraft, 844 Baltimore, Baltimore 1, Md.

SELL Nameplates, glass, signs. Sample (your name) 25c. Lawson, Box 347, Austin, Texas.

SELL Athlete's foot remedy. Money back guaranteed. \$1.50 investment nets you \$3.60. Write to Vel-Pet Co., 737 N. 26 St., Philadelphia, Penna.

WINDOW Sign letters—Large sizes, penny each. Special offer for general agents. Beautiful (glass-mounted) samples, free. Stamp appreciated. Atlas, 7911 Halsted, Chicago.

AGENTS—Coin money—It's new—It's hot! Everyone wants radiant plastic plaques of loved ones. Commissions advanced. We deliver, collect. Condon, Box 151, Upper Darby, Penna.

SILVER Plating and Polishing Liquid. Apply with cloth. Cleans, silverplated, polishes, one rubbing. Renews silverware, jewelry, musical instruments, automotive trim, etc., like new. NuSilver, Aurora, Ill.

CHRISTMAS Cards 50c and \$1.00 assortments. Generous profit. Jerry's Card Service, Box 28, Menomonee Falls, Wis.

TIRE Saver that amazingly extends the life of any tire and fixes punctures and slow leaks automatically as they occur. Brand new discovery selling for only 35c treats any tire. Big discount permits you to sell jobbers, dealers and consumers. Certified Products, Louisville, Ky.

\$3 FIRE Extinguisher: quick sales, wholesale or direct; liberal profits. "Fire-Killer," 109 N. Franklin, Syracuse, N. Y.

GAS Saving auto specialty—100% profit to you and dealers. We finance. Sample, contract 25c. Guthrie, Third Street, Bardonia, Kentucky.

EXCELLENT Sparetime profits handling subscriptions—2500 magazines. Confidential catalogue. Starting supplies free. Pines Subscriptions, Flushing, N. Y.

BIG Money taking orders; shirts, ties, socks, pants, jackets, sweaters, shoes, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AN Lincoln, Chicago.

SCIENTIFIC Manufacturing processes. Simplified! Profitable! Trade secrets! Profits to 1,500%. Lists free. Thermohwka, 4, Peoria, Ill.

PLATING Outfits for autopsies, reflectors. Connect to battery. No tanks necessary. Free sample and booklet. Gunmetal Co., Ave. N. Decatur, Ill.

WHOLESALE Sources, 500,000 articles. Free directory. Maywoode, 1133 Broadway, New York.

AGENTS: Sell "Champo" — Athletic champions favorite Antiseptic. Good profit, steady repeats. Send for circular. Generous sample 10c. Champo Products Co., 163 N. High St., Columbus, Ohio.

SELL New-used clothing from home, auto, store. Men's suits 99c. leather jackets 79c. overcoats 43c. dresses 12c. ladies' coats 38c. Other bargains. Catalog free. S&N, 565A Roosevelt, Chicago.

AMBITIOUS School seniors—Sell classmates the "tops" in graduation name cards. Best commissions. Free cards. Agencies going like wildfire. Hurry! Craftcards, Box 235-L, Pittsburgh, Penna.

EXCELLENT Sideline for printing salesmen. Decalcomania name plates in small quantities. Also, make money applying initials on automobiles. Free samples. "Ralco," 1483 Washington, Boston (18), Mass.

AGENTS—300% Profit selling gold leaf window letters; stores and offices. Free samples. Metallic Letter Co., 438-B North Clark, Chicago.

FREE Water and our concentrates, makes flavors, lotions, shampoos, 72 products, labels, bottles furnished. Qualico, E-20030 Russell, Detroit.

ELITE Collection contains 127 plans for starting own business; home, office. Descriptive booklet free. Elite Co., 214 Grand St., New York.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

CHRISTMAS Cards with name, 50 and 35 for \$1.00. Regular and religious box assortments. 4154-g Fifth Street, Philadelphia 40.

HIGH-GRADE SALESMEN

ADVERTISING Book matches. America's largest manufacturer of union label book matches. Fast selling line. Large sales producing kit. Sample matches. Complete cut catalog. 17 color combinations makes selling easy. Commission in advance. Superior Match Company, 1530 Greenwood, Dept. M-11, Chicago.

ADVERTISING Specialty men. Dated events war map offers big money to producers. Unrestricted sale. No priorities to worry about. Quick deliveries. Prompt commissions. Also available: limited supply of desk calendars in metal and leatherette. Other fast selling advertising specialties. State reference and selling record on your business stationery—or no attention paid. Gettler-Montanye, Inc., 405 W. Franklin Street, Baltimore 1, Maryland.

ADVERTISING Book matches—World's largest "direct selling" book match factory offers advance cash earnings calling on every type of business. Men or women. Experience unnecessary. Full, part time. Low prices. High quality. Quick deliveries. Powerful patriotic display. Special designs for army camps and naval stations. Repeats. Free kit, instructions. Match Corp. of America, 3433 West 48th Pl., Dept. E-11, Chicago 32.

SAMPLE Thirty dealers; sell 6,000 wallets; \$30.00 profit; 6,000 potential bonuses; thirty self mailer pocket wallets \$1.00 bill. Walrades, South Office, Oak Park, Illinois.

EARN Your withholding tax and more too by giving us couple hours weekly. No capital or experience required. Box 3, Winona, Minn.

BLADES—Best quality, factory prices. Details free. Ace Blades, Buffalo, N. Y.

EXTRA Christmas profits—Send for free copy! 1943 wholesale catalog, featuring imprint lines, box assortments, calendars, pictures, greeting cards. Substantial profits! Elkto, 438 North Wells, Chicago.

SALESMEN: Have real money making opening. Fits into war program. Old progressive firm. Dept. "F," Box 302, Dallas, Texas.

EDUCATIONAL AND INSTRUCTION

REFRIGERATION Service course. 24 easy well illustrated manuals. Free booklet. Mechanics School, Dept. P22, 4701 West Pico, Los Angeles 6.

EXCEPTIONAL Opportunity. Operate a collection agency-credit bureau. Quickly learned. Many make \$5,000 yearly. up. Write Cole Associates, Syracuse, N. Y.

TOOL Designing pays big. Home study course. Low cost. Easy terms. Free booklet. Ohio Institute of Technology, Box 122, Greenville, Ohio.

"HOW To Break and Train Horses"—A book every farmer and horseman should have. It is free; no obligation. Simply address Beery School of Horsemanship, Dept. 1111, Pleasant Hill, Ohio.

WELDING—Electric arc. Learn profitable trade quickly through actual practice. Individual welder instruction at bare cost of materials. Full particulars free. Valuable welding lessons book 50c. Hobart Welding School, Box M-1132, Troy, Ohio.

MAKE Up to \$25-\$35 week as a trained practical nurse! Learn quickly at home. Booklet free. Chicago School of Nursing, Dept. K-10, Chicago.

EARN Certified Grapho-Analyst degree analyzing handwriting. Students report earnings up to \$1.00 an hour sparetime. \$75.00 weekly full time. Graduates in employment, credit agencies, police departments, courts, business and in private practice as personal problem and vocational advisors. Fully illustrated Grapho-Analyst and 3000 word illustrated lesson free. Institute, Box 1150, Joplin, Mo.

WRITE Servicemen; others. Learn thru booklet, "Dynamic Letters," 25c. Hall Publishing, Oak, Dalton, Massachusetts.

WAR Workers and students. For advancement and better pay you must know mathematics and blueprint reading. Personal instruction by mail at low cost. Write Lyle, Box 1240, Sarasota, Florida.

LEARN Blacksmith tempering and holding colors. Copyright booklet postpaid 50c. Smith, P.O. Box 202 East Lansing, Mich.

DETECTIVE Training. Phillips Secret Service, 1917-B N. Kenneth, Chicago, Ill.

MAGNETIZE Your mind! Attract wealth, health, happiness. Explanation free. Publishing Research Guild, Anaheim, California.

SIGHT-TRAINING Technique improved. Everybody gets results now. Ask for free chart and instructions. Write Dept. M, 4057 Budlong Ave., Los Angeles 37, Calif.

PROFITS Without merchandise! 10,000 word course \$2.00 postpaid. Challenge Association, A-10, Cincinnati.

TYPEWRITER Course, 12 lessons, general, speed typing, etc., complete instructions \$2.00. Muir Co., 271 King William, Hamilton, Canada.

DRAFTSMEN—Increase your income. Prepare for peace time. Definite instructions for earning hundreds of dollars by improving drafting ability. \$2 complete. Draftsmen's Foundation, Rm. 901, 45 Milk St., Boston, Mass.

POETRY: Competent instruction, correction, publishing. Literary Service, 25 West 3rd Street, New York 12.

BEAUTIFUL Penmanship—Interesting spare-time course. Hotel School, 33 Mohican, Dobbs-Ferry, New York.

LEARN To sing beautifully through modern voice culture. Literature free. Ferris, 317A So. Hartford, Bremerton, Wash.

USED Educational books on all subjects sold, rented, also bought and exchanged. Moneyback guarantee. Write today for free catalog and details. Lee Mountain, Pisgah, Alabama.

NEW Writers wanted to re-write ideas in papers, magazines, books. Splendid opportunity to "break into" profitable writing field. Rush postcard for free details. Comfort Writer's Service, 210-P South Seventh (2), St. Louis, Mo.

BE A doctor. Learn chiropractic. Fast growing profession. Resident course only. Write for catalog. Texas Chiropractic College, San Pedro Park, San Antonio, Texas.

SHORTHAND In ten lessons. Sample. Kee-Way System, Syracuse, N. Y.

LEARN Armature winding at home. Make big money! Investigate. Prazer, P.O. Box 5086, Zone 1, San Francisco, Calif.

MEDICAL Laboratory technicians in great demand. We train you in your spare time, in your own home. You can practice while studying. Write for free catalog. Imperial Technical Institute, Box 973-E, Austin, Texas.

SECRET Investigation. Experience unnecessary. Detective particulars free. George Wagner, M-125 West 88th, New York.

GOOD "Used" educational books on all subjects bought, sold, rented, exchanged. Satisfaction guaranteed. Complete details and 64-page illustrated bargain catalog free. Write Nelson Company, 321 South Wabash, Dept. 208, Chicago.

DRUNKENNESS is a disease which responds to treatment. Medical skill plus human sympathy prove successful with liquor and drug cases. 60 years experience. Write for free booklet. P. M. Nelson. The Keeley Institute, Dwight, Ill.

LOCKSMITH Course. Lock picking, key fitting, etc. \$1.00 prepaid. Locksmith, Canadian, Texas.

RADIO Engineering, broadcasting, servicing electronics, aviation, marine and police radio taught thoroughly. All expenses low. Co-educational. Catalog free. Dodge Institute, Dept. R, Valparaiso, Ind.

HOME Study course, drugless therapy. Free literature. Inst. of Drugless Therapy, Tama, Iowa.

LEARN To Relax. Write for information. Relax, 505 D St., Petaluma, Calif.

PLAYS, STORIES, MANUSCRIPTS

3 STORY Plots 50 cents. Plot Builders, 321 E. Laurel St., Fort Collins, Colorado.

CARTOONING, COMMERCIAL ART, SHOWCARD WRITING, SIGN PAINTING

QUICK Landscape painting course \$3.00. List free. Sign, Dept. P.M., Farmington, Missouri.

CARTOONING: Easy method course—36 lessons, 6 books, 816 illustrations, complete, \$2.85. Home Cartooning Instructions, 3456 West 116th St., Chicago.

BECOME Cartoonists quickly with new, streamlined method originated by prominent cartoonists! Originate comic characters instantly! Sell your work to newspapers, magazines, advertisers! Send only \$2.85! Keep the course three days, then if not entirely satisfied, return and full purchase price will be promptly refunded. National Artists, P.O. Box 4248-A, Dallas 8, Texas.

CHALK Talks. Laugh producing program, \$1.00. Catalog 10c. Balda The Cartoonist, Oshkosh, Wisconsin.

CARTOONING Course—30 illustrated lessons, over 500 sketches, \$1.00 postpaid. Montes Studio, Box 892, Pasadena, Calif.

ADVERTISING AGENCIES, LETTER WRITERS, FOR ADVERTISERS

ADVERTISE Profitably: \$15 reaches 5,000,000 Sunday newspaper readers with 24-word ad. Newspaper, magazine, mailing-list ratebook, free. Chicago Advertising Agency, 20-PA West Jackson, Chicago.

SPECIAL Low-costing, most effective, inexpensive advertising. Write Van Scoy, 1501 West 11 Place, Los Angeles.

SIGNS. Beautifully hand lettered, 7"x11". Any 2 lines. Send copy, dollar. Neslon Signs, 1953 Myrtlewood, Philadelphia.

INCH Display advertisement, 50 magazines, year \$15. Wood's Popular Services, Atlantic City, (N. J.)

ART-WORK. Lettering, illustration, designing. Gill, Box 675, Huntsville, Ala.

ADVERTISING Placed, any publication, lowest rates, complete agency service. Skilled advertising—merchandising counsel. Ratebook and booklet, entitled "Advertising Results For Sale," free. Baker Agency, 3302 Dodge, Omaha, Nebraska.

ADVERTISE —Newspapers, magazines. Publishers' rates. Marlin Agency, 1718 Madison Avenue, New York.

COMMERCIAL Art, advertising illustrations, any purpose. Trade-mark, letterhead or label designing. Reasonable prices. Baker Studios, 3302 Dodge, Omaha, Nebraska.

FREE—New Advertisers Rate Guide. 44 pages. Includes everything. Lowest rates. E. H. Brown Advertising Agency, Merchandise Mart, Chicago.

FREE—"Amazing New Book"—"Profits From Classified Advertising." Tells how and what to advertise. Be sure to read this book before you invest one cent in advertising. Remember—it's free! Write for your copy now. F. W. Johnson, Classified Advertising Manager, 200 East Ontario Street, Chicago, Illinois.

ADVERTISE: 24 Words, 149 newspapers, \$6.50. Lists free. Advertising Bureau, 4515-G Cottage Grove, Chicago.

ADVERTISING Placed all magazines, newspapers U.S.A., Canada. Lowest rates. Free service. 54-page catalog free. Baker Advertising Agency, A-189 W. Madison, Chicago.

24 WORDS. 35 Newspapers \$2.00. Goodall, 37 Gardner, Vallejo, California.

BUSINESS SERVICE

HOLLYWOOD. Movieland prestige mail address for business and personal mail. Received and forwarded daily. Only \$2.00 mo. Mary Ennis, Box 2967, Hollywood 28, California.

JACKSONVILLE, Fla., mail address \$2.00 monthly. Your mail received and forwarded daily. Empire Mail Service, Box 86, Jacksonville, Fla.

BOSTON Mail address: Receiving, forwarding, \$1 month, 110 State St., Room 502.

WASHINGTON, D. C. mail service receives, forwards, M&W Service Bureau, 1401 - 25th St. S.E., Washington, D. C.

HAWKINS Mail Service, Washington, D. C., receives, re forwards, business, personal mail, \$1.00 monthly, No. 9 Randolph Place.

PHILADELPHIA Mail address. Re forwarded daily. Business, personal. Graham System, Real Estate Trust Bldg.

WE Collect notes. Accounts everywhere. No charge unless collected. May's Collection Agency, Somerset, Ky.

TYPEWRITERS, DUPLICATORS, OFFICE DEVICES

DUPLICATORS And supplies. Office appliances, etc. Write DixieGraph, King, N. Carolina.

RE-DYE Your typewriter ribbons. Details free. Thomas J. Vachon, Lancaster, New Hampshire.

TYPEWRITERS. Adder, mimeograph, multigraph, addressograph. Send for free lists of machines that will help you at half price. Pruitt, 28 Pruitt Bldg., Chicago.

"PRINTOMATIC" Self-feeding rotary stencil post card printer, complete, \$9.50. All makes duplicator supplies. Literature free. Pittsburgh Typewriter Supply, 336-R Fourth Avenue, Pittsburgh 22, Penna.

RUBBER STAMPS, OFFICE SUPPLIES

3 LINES 30c; Cushioned, Indexed, 35c. Signatures \$1.50. Stamprite, Wauwatosa, Wis.

ONE Line 15c, 2-25c, 3-35c. Stamp Works, Auburn, Nebr.

KNOB Handle, cushioned, 2 lines 30c, 3-40c. Stamp Works, Centerport, N. Y.

SUPERIOR. Three lines 35c, four 50c, service clothing marking outfits \$1.25. Signatures \$1.50. Slocum, 814 Bradley, Peoria, Illinois.

ONE Line 15c, 2 lines 25c, 3 lines 35c. Excello Sales, Dept. B, Box 500, Shreveport, Louisiana.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING, GUMMED LABELS

PERSONAL Xmas cards, 21 French fold 1942 quality, name printed free, \$1.00 cash. Check or M.O. Edgewood Press, Box A-367, Edgewood, Maryland.

PERSONAL Imprinted stationery—300 sheets and 150 envelopes, \$1.50 postpaid. Certified, Box 1004, Atlantic City, N. J.

BETTER Grade printing, reasonably priced. Modern Print, Box 34, Hyattsville, Maryland.

5000-6x9 CIRCULARS. Postcards, \$3.75; envelope slips, \$3.75; typewriter letters, \$11.48. Samples. Goodprint, Harrisonburg, Va.

\$1.00 POSTPAID-100 8 1/2x11 Bond letterheads and 100 envelopes. Benneville, 907 West Roosevelt, Philadelphia 40, Pa.

THOUSAND 6x9 Circulars \$2.95. 5,000 advertising postals, \$7.95. Free samples. Reporter, Chelsea, Oklahoma.

500 LETTERHEADS. Good 8 1/2x11 bond, 500 6 3/4 envelopes, neatly printed, \$4.60 prepaid. Rolna, Box 788, Pittsburg, Calif.

YOUR Picture and name beautifully printed on 50 sheets \$1.00. Samples. Send negative. James Davis, Eaton, Ohio.

100 LETTERHEADS. 100 Envelopes, \$1. Demon Press, Box 111-P, Roseville, Mich.

HAMMERMILL Bond stationery. Low prices. Samples. Gooch, 202PM, Hernando, Miss.

100-8 1/2x11 LETTERHEADS And envelopes \$1.15. Journal, Ragan, Nebr.

PARCEL Post labels printed two colors including your return address; size 3x4 1/2 -200-\$1.00, 500-\$2.00, 1000-\$3.75, 5000-\$12.50 postpaid. Sample and printing price list free. Edgewood Press, Box A-367, Edgewood, Maryland.

8 1/2x11 OFFICE Forms, ruled and printed to your specifications, average \$6 first 1000. Special quantity prices. Quality work. Burr Printing Company, Norwich, N. Y.

500-8 1/2x11 LETTERHEADS. White, 3-line copy, \$2.50. Crowe, Boelus, Nebraska.

\$1.00 POSTPAID: 100 8 1/2x11 Bond letterheads and 100 6 3/4 envelopes. Mero Products, Box 344, Punxsutawney, Penna.

5,000 3x6 CIRCULARS \$3.75; 6x9, \$8.50 Prepaid. Samples and copy System Magazine, stamp. Clarence Herr, Printshop, Sheridan, Penna.

500 BUSINESS Cards printed \$1.00 postpaid. Artcraft Printers, 97-02 Roosevelt Ave., Corona, N. Y.

1000 6x9 FOUR Page booklets expertly printed \$28.00, 5000-\$100. Samples. Giddings Print Shop, 2544 Clarkson Street, Denver, Colorado.

DISTINCTIVE Printing. Hammermill papers. Lowest prices. Samples. Dickerson Printing Co., Gas City, Indiana.

100 8 1/2x11 BOND Letterheads and 100 envelopes printed \$1.25. Printshop, Linton, Ind.

ECONOMICAL Printing. Good work. Good materials. Send postal for free novelty, samples, prices. Victory Printers, 1506 East 6th, Amarillo, Texas.

BARGAINS: Printing, mimeographing. Free price-list. Fray, 7207 N. E. Skidmore, Portland 13, Ore.

ENVELOPES Without cost. Samples, stamp. Wood, 246 Main, Brockton 1, Mass.

125 LETTERHEADS And 125 envelopes, \$1.50 prepaid. Gage Print Shop, Box P1544, Muskogee, Oklahoma.

PRINTING. All kinds, best work. Try Edwards Press, 5217 Filbert, Philadelphia.

1000-6x9 CIRCULARS For \$1. Armand Cartier, 095A North, Pittsfield, Mass.

MIMEOGRAPHING—Letters, pricelists, formulas, instructions. Lowest prices. Lem's Letter Shop, 5710 Stanton, Detroit 8.

BETTER Grade printing reasonable. Estimates on anything. Economic Press, Leonia, N. J.

500 3/4x2 1/4 FOUR Line gummed stickers, 25c. Moritz Printery, Saginaw, Mich.

500 4-LINE Stickers, 25c. Press, 749 S. Plymouth, Rochester 8, N. Y.

PRINTING OUTFITS AND SUPPLIES

INEXPENSIVE Home-made printing press. Details free. Novelty Shop, Downsville, Louisiana.

PROFESSIONAL Stencil postcard printer, complete, \$2.45 postpaid. Challenge Association, B-10, Cincinnati.

PRINTING Outfits and supplies. Send stamp for details or dime for complete illustrated supply book. Kelsey, Inc., W-11, Meriden, Conn.

TYPELESS Printer. Printopress stencil duplicator. Lowest price. Professional Products, Madisonville, Cincinnati.

PRINT At home. 10c will bring a complete catalog of presses, type and supplies. P. Peiffer & Company, 6 Columbia St., Newark, N. J.

BARGAINS — Presses, type, supplies. Send stamp. 159 Harvard, Cambridge, Mass.

PRINTER'S Supply bargain catalog. Send stamp. Bradshaw, 3214-S, Chicago 24.

USED Presses, type, supplies. Lists 3c. Turnbaugh Service, Laysville, Penna.

PATENT ATTORNEYS

INVENTORS—First things come first. Your first move toward securing a patent on your invention is acquiring full information on what to do. Our two books "Patent Protection" and "When and How to Sell Your Invention" contain this information and other helpful data. Get them immediately, together with our "Evidence of Invention" form. They cost you nothing, you assume no obligation. Write now to Victor J. Evans & Co., Registered Patent Attorneys, 731-M Merlin Building, Washington, D. C.

"PATENT-Particulars" and blanks, free, airmailed. Sterling Buck, Park-North Avenues, Baltimore, Md. Government-registered 36 years.

INVENTORS: Learn now—without obligation—how to protect and sell your invention. Secure free "Record of Invention" form with instructions for making disclosure and establishing date of your invention—and free "Patent Guide for the Inventor," containing complete information about patent procedure and selling inventions; giving illustrations of many successful inventions; over 150 basic mechanical movements. Delay may be costly. For prompt, confidential service—write to—Clarence A. O'Brien & Harvey Jacobson, Registered Patent Attorneys, 318-L Adams Building, Washington, D. C.

INVENTORS—Before disclosing your invention to anyone send for form "Evidence of Conception"; "Schedule of Government and Attorneys' Fees" and instructions. Sent free. Lancaster, Allwine & Rommel, 411 Bowen Building, Washington, D. C.

PATENTS—Trade marks. Preliminary advice, book and disclosure form free. Personal service. Irving L. McCathran, 315 McLachlen Bldg., Washington, D. C. Registered Patent Attorney.

PATENTS. Promptness assured. Wilfred E. Lawson, 1524 K Street N. W., Washington, D. C.

"INVENTOR'S Guide." 100 mechanical movements, free; advises on patenting, selling inventions. Frank W. Ledermann, 154 Nassau Street, New York.

PATENTS. Protect your idea by securing free "Proof of Invention" folder. Exceptional personal service. Established 1906. E. E. Vrooman, 871 Woodard Bldg., Washington, D. C.

L. F. RANDOLPH, 302-B Columbian Bldg., Washington, D. C. Low cost. Book and information free.

FOR INVENTORS

INVENTORS: Learn now—without obligation—how to protect and sell your invention. Secure free "Record of Invention" form with instructions for making disclosure and establishing date of your invention—and free "Patent Guide for the Inventor," containing complete information about patent procedure and selling inventions; giving illustrations of many successful inventions; over 150 basic mechanical movements. Delay may be costly. For prompt, confidential service—write to—Clarence A. O'Brien & Harvey Jacobson, Registered Patent Attorneys, 31A-L Adams Building, Washington, D. C.

INVENTIONS Developed. Drawings made. Engineering calculations computed. Machinery designed to order. Light manufacturing done. New shop formulas supplied. Good tools bought and sold. Clinton Davidson, 636 C St., San Diego, Calif.

CAN Inventors make money today? In 1941 alone over 4,000 assignments of patents a month were made by inventors to manufacturers or individuals. This shows today's demand for new patented inventions. Write for our free book, "Protect, Finance and Sell Your Invention." Special form "Invention Record" also mailed free. No obligation. McCormack & Berman, 134-Z Albee Building, Washington, D. C.

INVENTORS—Information on what to do first toward securing a patent on your invention is of vital importance. "Patent Protection" and "When and How to Sell Your Invention"—two valuable, richly illustrated books—explain fully what to do first, and a lot more. Get this information quickly together with "Evidence of Invention" form. All three will be sent to you free. Write immediately to Victor J. Evans & Co., Registered Patent Attorneys, 732-M Merlin Building, Washington, D. C.

INVENTORS—If you want to sell a patent or patentable idea, read our ad on page 22A, Industrial Engineering Co.

INSIDE Information on how to sell your ideas. Years of experience. Write to C. H. Taylor, Room 519A, 28 Worthington St., Springfield, Mass.

PATENTS Obtained. Complete inventor's service. Invention Bureau, 2224 Shurdevant, Davenport, Iowa.

INVENTORS. Patented or unpatented we promote your invention. M. Humphries, 812 Otis Bldg., Philadelphia, Penna.

INVENTIONS Developed, patented, financed, commercialized. Allied Patent Enterprises, Dept. 3C, P.O. Box 3701, Los Angeles 459, Calif.

NEW Glend stimulating vitamin. Details accompany "Colchicine" offer. See "Chemistry."

I SELL Patents. Established in 1900. Charles A. Scott, 713PM Garson Ave., Rochester, N. Y.

INVENTORS: New military and commercial inventions urgently needed by manufacturers. Write for particulars. Chartered Institute, Dept. 4-A, Washington, D. C.

CASH For practical ideas and inventions. Mr. Ball, AB-9441 Pleasant, Chicago.

INVENTIONS WANTED

ALL Kinds. We have facilities and finances to make and sell your ideas, both mechanical and chemical. Send model, sample, details and wishes. General Sales & Supply Company, 110 East Main St., Madison 3, Wisconsin.

WANTED—New tools for automotive and aircraft work. Will buy patents or designs outright or as finished tools. Give details. Husky Tools, Box 56, New Britain, Conn.

PLASTIC Manufacturer will buy or manufacture on royalty basis, patented or patentable articles. Twenty years plastic experience. United Plastic Works, 8947 Exposition Blvd., Los Angeles 34, Calif.

CASH For inventions, patented, unpatented. Mr. Ball, A-9441 Pleasant, Chicago.

KNOW-How on presenting your ideas. Personal success for years. Write to C. H. Taylor, Room 519B, 29 Worthington Street, Springfield, Mass.

IDEAS Wanted for post-war manufacture—household devices, hand tools, electrical and electronic devices. We find a manufacturer or buyer for you. See our ad, page 22A, Industrial Engineering Co.

NEW Product ideas. A reputable manufacturer will consider new patentable items (preferably of metal) for manufacture and distribution in the aircraft, automotive, marine, industrial, or household field. Ideas will be purchased outright or on royalty if accepted. Write briefly the nature and intent of your idea and, if interesting, we will send complete instructions on how to submit full details for fair consideration. Address P.O. Box No. 6793, Philadelphia, Penna.

INVENTORS: Have you a sound, practical invention for sale, patented or unpatented? If so, write Chartered Institute of American Inventors, Dept. 4-D, Washington, D. C.

WANTED—Meritorious patented, unpatented inventions. Booklet, references, free. Invention Reporter, 5B-11236 So. Fairfield, Chicago.

PATENTS FOR SALE

SELL Outright. Patented gadget removes Spanish moss from trees, telegraph, telephone and electric light wires. I. Scudder, 9201 Hudson Boulevard, North Bergen, N. J.

FISHERMAN'S Ice cutter. Pat. No. 2301478, John W. Boomer, Sr., 64 No. Cass, Pontiac, Michigan.

PATENT. Electric, Outright. Royalty. Makes cars start easy when cold. Meyer, 1845 E. 37, Brooklyn, N. Y.

RULE (Patented) for computing number boards in logs. Anton Waeitz, New Athens, Illinois.

PATENT 2216984. Cooking utensil, all methods of cooking. Unusual sales appeal. Cash or royalty. W. T. Pearson, 1018 South St., Vicksburg, Miss.

ATTENTION Manufacturers. Patent No. 2327054. An automobile blow out proof hydraulic stop light switch. Will sell cheap. P.O. Box 550, Steelton, Penna.

DRAFTING Instrument of improved form, comprising a double protractor element with coacting scale, representing 700 degrees of a circle. Other new and useful features designed to meet the demands for speed and accuracy. Write Geo. I. Fischer, 1014 Abercorn Street, Savannah, Georgia.

MANUFACTURING

MANUFACTURING. Models, inventions, tools, turnstiles, stampings. Catalog. Baum's Metal Specialties, Kansas City, Mo.

PRECISION Lathe machining, inventions, production designing, models, slender blueprints sold. No jobs too small. Specialty Machine Shop, 2821 Mitchell St., Racine, Wis.

MODELS—Small lot manufacturing. Metals, plastics, etc. Milburn, Burlington, Kentucky.

MODELS AND MODEL SUPPLIES

ENGINES. Planes, hundreds of hobby items. Catalog 25c. G.H.Q., Dept. BT, 40 E. 21 St., New York 10, N. Y.

CATALOG 60 Engines, model railroad supplies, 25c refunded. Howardo, A2417 North Ashland, Chicago.

MODEL Kits and supplies, catalog 10c. Steve Patti Co., 1433 W. Forest Home Ave., Milwaukee 4, Wisconsin.

SHIP Models and yacht supplies complete. Large 64 page catalogue 20c. Bill Wild's, 510 East 11 St., New York City.

SHIP Model kits and fittings. Complete line Fisher model yacht equipment. All Boucher, Fisher, Marine Model and Ideal kits, fittings and blueprints at standard prices. Most complete stock in New England. James Bliss & Co., Inc., 230 State Street, Boston, Massachusetts.

RAILWAY Models, complete line informative catalogs O gauge, 104 pages, 25c; HO, 48 pages 15c. Walthers, 247 Erie, Milwaukee, Wisconsin.

HOME CRAFTSMEN

MAKE YOUR OWN smoking pipes. Briar pipe blocks 30c. Stems 15c each. Michelson & Sternberg, Inc., 116 Broad Street, New York City.

I MANUFACTURE Toys, novelties, shelves that really sell. Your opportunity to make some money with these attractive modern patterns. Ten for \$1.00. Homer Gabert, Eau Claire, Wis.

UNIQUE Sturdy wood stroller with shopping compartment. Complete original plans 25c. K. Stultz, 146 William St., Alexandria, Va.

SQUAREKNOTTERS! Make belts, handbags, etc. Quality cord samples with catalog, free. Beginners book, catalog and samples 10c. Special Regular \$1 book with 50c beginners outfit, all for \$1. P. C. Herwig Co., Dept. J-42, 121 Sands St., Brooklyn, N. Y.

WANTED—Home workshop to make small toys. Samples sent on request. Milbern Specialties, 1305 W. Carroll Ave., Chicago, Ill.

28 LAWN Ornament patterns 25c. Other patterns: 15"-20" high; Dutch girl, Dutch boy, pirate, bull terrier, Mexican girl, Mexican boy, dwarf, penguin, flower girl, 10c each; 3 for 25c. 25 novelty patterns 30c. All 62 full size patterns \$1.00 postpaid. Strother, Box 383-EY, Bellington, W. Va.

CATALOG: Tools, decal transfers. Patterns novelty furniture, lawn ornaments, silhouettes, letters and numerals. Other lines, 500 articles finely illustrated. Write Wo-Met Shop, Ashburn, Georgia.

TOBACCO, SMOKERS' SUPPLIES

IMPORTED Briar pipes. No putty, plugs or clay fills. No stain or varnish. Genuine imported virgin briar. Excellent quality. Only \$1.75. Send for free catalog and trial offer. Sidney Ram, 59 West Monroe, P-20, Chicago 3, Illinois.

FREE To pipe smokers—For a new pipe smoking thrill, write us your brand of tobacco and we'll free package a mild, tasty, natural-flavored "Green River." Pete Moberly, Box 267, Owensboro, Kentucky.

WATCHES, OLD GOLD, JEWELRY

GOLD \$35.00 Ounce. Mail old gold teeth, diamonds, jewelry, watches. Receive cash by return mail. Satisfaction guaranteed. Free information. Dr. Welsberg's Gold Refining Company, 1500-Q Hennepin, Minneapolis, Minn.

GENUINE Diamonds, out-of-pawn low prices, wonderful values. Unredeemed loans and big buying power enable us to offer beautiful gems at prices far less than original cost. Shipped free for inspection, appraisal. Send for big free list showing fine diamonds at startling low prices. Lloyd J. Butler, President, Prudential Loan Association, 133-LM North Clark St., Chicago 2.

WATCHES. Materials, tools, jewelry, diamonds—bought—sold. Catalogue. Gales, Box 1000, Chicago.

OPALS. Sample packet \$5.00. Catalogue free. Norman Seward, Melbourne, Australia.

HIGHEST Prices for old gold—Mail your teeth, watches, jewelry. 100% full cash value mailed day shipment received. Satisfaction guaranteed or articles cheerfully returned. Information free. Chicago Gold Smelting Company, 300-P Champlain Building, Chicago.

WANTED—MISCELLANEOUS

WANTED To buy—Small South Bend or Atlas lathe of fairly recent model; also other metal working equipment for home workshop. Blaine Earl, Glendale, Ohio.

WANTED To buy used and new boxing, wrestling, Jiu-Jitsu and other forms of self-defense especially la-savate instruction books, courses, pamphlets and clippings. Osmo Tuiskula, 15 Windsor St., Worcester 3, Mass.

ENOUGH Red leather to reupholster, complete, a 1936 Ford phaeton; also new or used supercharger for same. Fred Lindstedt, 77 Hillside Ave., Oakville, Conn.

ACCORDION—Any condition. Give description, price. Chaton, 600 Blue Island, Chicago.

CASH For bicycle engines, outboards, motorcycles, scooters, gasoline engines, exercycles. Describe, quote prices. Clymers, 307 W. Pico, Los Angeles 15, Calif.

WE Pay you well for "anything" you wish to sell: merchandise; jewelry; tools; instruments; equipment. Justice Jobbers, Box 150, Chicago.

MERCURY (Quicksilver). We pay \$1.50 per pound. Western Metal Co., Bloomington, Illinois.

GASOLINE And oil tanks, 5000 gallons and larger. Stanhope, Wayne, Penna.

MERCURY (Quicksilver), tungsten, molybdenum, cadmium, high speed tool steel, bismuth, purchased in any quantity. Write for quotations. Metallurgical Products Co., 35th and Moore Sts., Philadelphia, Penna. Established 1909.

CASH For used optical, mechanical, scientific instruments. Gordon's, 162-PB Madison, Chicago.

PERSONAL

PSORIASIS Sufferers: Pixacol has brought relief when everything else failed. Caution: Use only as directed. Apply externally, dries quickly, convenient. Try regular \$1 bottle without investing a cent! Write: Pixacol, Box 1298, Cleveland, Ohio.

YOUR Name is important. Get complete fascinating analysis from Nothing but Truth broadcaster praised in Saturday Evening Post. Send \$1.00. Alexander McQueen, 185 East Chestnut, Chicago.

LIVE Longer, feel better, enjoy life. Free information. Fairchild Company, Mt. Vernon, Ohio.

NEXT Time you "feel rotten" try breathing right! Capt. Godfrey Rodriguer was discharged from the Dutch army as incurably tubercular. Today he has a chest measurement of 46", a waist of 34" and a chest expansion of 9" . . . and all he did was learn how to breathe. "Right breathing will rid you of 'a bay window,'" says Rodriguer. "Right breathing has made me immune to colds and coughs, sinus and flu. I defy anyone to give me a cold." Send for particulars regarding Rodriguer's simple method of breathing. No obligation. A. J. Shutt, P.O. Box 323, New Castle, Ind.

GORGEOUS Christmas folders, 25 for dollar or 50 for dollar, your name printed free. Lefavor, Box 571, San Bernardino, Calif.

BEAUTIFUL Stamp-size photographs expertly reproduced from your favorite picture. 100—\$1.50. 50—\$1.00. Jack Tupper, 1121 Mateo, Los Angeles.

"HOW To Keep Your Hair Till Ninety." This informative and educational pamphlet mailed free. Write James Hilton, 4819 Fourth Ave., Brooklyn 20, N. Y.

DEVEX Formulas for athlete's foot. Helps heal broken tissues. Stops itching. Relieves soreness. Leaves feet soft, smooth. Sample, Devex, 7814 Franklin, Cleveland, Ohio.

BUY Vitamins direct. Save. Postcard. Matoska Products, White Bear, Minn.

MEXICAN Legal matters reliably handled. A. Munoz, 240, Juarez, Mexico.

"GRUVED Letters" guide your hand—quickly correct your penmanship. Write, Osmont, 9, St. Louis, Mo.

ATHLETES Foot sufferers: Brooks athletes foot treatment, brings relief where others failed. Send \$1 for guaranteed results. Brooks Mfg. Company, Box 152, Hartford, Conn.

DRUNKENNESS Is a disease which responds to treatment. Medical skill plus human sympathy prove successful with liquor and drug cases. 60 years experience. Write for free booklet. P. M. Nelson, The Keeley Institute, Dwight, Ill.

MISCELLANEOUS

HAVE Income via postman. Fascinating, profitable, different. Hagen, 1410-A Peden, Houston 6, Texas.

FLORIDA Products, novelties, etc. Valuable literature, stamp. Box 117, Little River St., Miami 33, Fla.

HONOR Rolls. Changeable letter and changeable name strip styles to list large and small capacities. Send for illustrated folder. Acme Bulletin & Directory Board Corporation, 37 E 12th St., New York City.

MEXICAN Jumping bean season closes December fifteenth. Dozen beans 25c, hundred \$1.00. Mexican Products, 126 North Main, Tulsa, Oklahoma.

VICTORY Quilt pattern, can be used for other articles. Copyright drawings, specifications and instructions for this beautiful pattern 20c postpaid. Satisfaction guaranteed. Give a friend one, birthday or Christmas. A. L. Hess, 816 1/2 W. Main, Marshall, Minn.

LARGEST "Big mail" in world and name inserted 10c. "Directory," 319 So. Marengo, Pasadena 5, California.

GREAT Fun. Letters mailed for you: N. Y., Chicago, Miami, Montreal, 15c. Souvenirs, view cards, information 10c. Agents proposition 25c. Haller, 436 N. Y. Ave., Brooklyn 25, N. Y.

VITAMINS—The One-Cent-Way. Send postcard for details. Video, Box 2032, Philadelphia, Penna.

BIG Mail for you. Latest moneymaking offers, opportunities, catalogs, magazines. Name listed in directory 10c. Ideal Service, 144-M, Park Ridge, Ill.

UNUSUAL Novelties, samples 10c. Modern, Box 2, Station B, New York City-2.

BURGOLARS Kept out homes, 25c. Naway, 35N 9th, Columbus, Ohio.

MAKE Delicious Caramelcorn, formula 50c. Frank Shilling, 1017-P Dueber, Canton 6, Ohio.

"44 ESQUIRE Desk calendars—Twelve Varga girls 50c. Esquire Agent, 1919 Girard, Philadelphia, Penna.

"EBONEE"—World's best—Asphalt coating. Essential Products Co., Williamsburg, Mo.

MAKE Your own printing cuts. "Plas-to" method, simple, practical. No messy chemicals. Adayservice, Argyle, Wisconsin.

MEND Socks, shirts without sewing. Use hot flatiron and our tested cloth patches. Complete 25c. Korn, 350 Irving, Brooklyn, N. Y.

BEAUTIFUL Handloomed Mexican tablecloths. Details free. Francis Coleman, Anthony, New Mexico.

2000 SWAPS In Traders Bulletin. 20c mailed. Ads 5c word. Swapping instruction course \$1.00. 234 Lake St., Chicago.

RECEIVE Mails, magazines, samples. Your name in numerous mailing lists 10c. Howard, 396 Broadway, New York.

FOTOSTAMPS: Free samples. Luther Sloan, Department 4, La Frank, W. Va.

GIVE Fotostamps for Christmas. Free samples. Graham, Box 1112, Lancaster, Calif.

"ONE Down, Two to Go!" Large comic cartoon Uncle Sam slaps the Axis. Very funny. 30c. Neslon Cartoons, 1953 Myrtlewood, Philadelphia.

OIL Portraits on canvas, 16"x20", \$50.00. By celebrated artist. Roseart Studio, 237 Hearne, Cincinnati, Ohio.

HEATING Six rooms \$20 yearly. Circulars 10c. Rosenzweig, RR10A2, Cincinnati.

INFORMATION For treasure seekers. Write. Wyss, 104½ Francis, St. Joseph, Mo.

UNPAINTED Wall plaques. 30 different \$1.00. 100 assorted \$2.00. Request literature. Oman, 642 Broadway, St. Paul, Minnesota.

HOBBY? 800 Hobbyists' addresses, magazine, 25c. Paulbaum, 170 S-Sunnyvale, Pasadena 8, California.

FIRE Out or too hot? Save coal. Use only half the firepot of regular furnace for fall and spring heating. Instructions 25c. Bennett, 37 Phelps, Rochester 6, N. Y.

SAVE Fruits and vegetables with recently perfected airtight coating. Seals in flavor, freshness and moisture. Keeps out air, flies and mold. Easy to use. Economical. No waste. Guaranteed. Melt product, dip fruits or vegetables, store until wanted. 5 pounds one dollar postpaid Illinois and adjoining states. Elsewhere \$1.25 postpaid. Quantity prices upon request. Money order or certified check. Century Laboratory, 30 West Washington, Chicago, Illinois.

MECHANICAL Drawing set, 9-piece, complete in outfit with 13 other essential drawing needs—\$18.25. Send for free complete catalog of drafting supplies. Gordon Co., 162-P Madison, Chicago.

ANY Book (new, used, out-of-print, rare) promptly supplied! Lowest prices! Send for free bargain catalogues! Old Prof's Book Shop, M16 Arcadia Court, Pontiac, Mich.

MEDICAL Laboratory technicians in great demand. We train you in your spare time, in your own home. You can practice while studying. Write for free catalogue. Imperial Technical Institute, Box 973-J, Austin, Texas.

BUILD THE BIGGEST \$1.00 PLANE IN U.S.

Huge 7-Ft. Super CONDOR Glider Soars for Hours

Stronger, longer flights, more graceful lines, construction simplified. Easier than ever to build. Kit E-5019, only..... \$1.00

Big 3-Ft. Famous War Models

Kit T74—Messerschmitt ME-109; Kit T76—Bell Alracobra P-39; Kit T77—Curtiss P-40 "Warhawk"; Kit T85—P-38 "Lightning"; Kit T78—Hawker "Hurricane"; Kit T91—P-51 "Mustang". Each Only \$1.50

If Dealer Can't Supply, Order Direct

CLEVELAND MODEL & SUPPLY CO., 4508C105 Lorain Ave., Cleveland 2, Ohio

Get this Handy OHMITE Ohm's Law Calculator!

10¢



Figures Ohms, Watts, Volts, Amperes—Quickly, Easily!

Solves any Ohm's Law Problem with one setting of the slide. Requires no slide rule knowledge. All values are direct reading. Scales on two sides

cover the range of currents, resistances, wattages and voltages commonly used in Radio and Electrical Work. Size 4½" x 9".

Send only 10c in coin to cover cost of handling.

OHMITE MFG. CO., 4930 Flournoy St., Chicago, Ill.

Always write your name and full address clearly when answering advertisements.



PULVEX FLEA POWDER

25¢ AND 50¢

PLAYS

Send for FREE catalog of 163 plays, copiously illustrated. Non-copyright plays, also tested plays on a percentage royalty basis. Playbook contains many famous plays are nationally famous for their high quality. Ask for live drama newspaper, "Lagniappe,"—it is free. ROW, PETERSON & COMPANY, 1905 Ridge Ave., Evanston, Ill.

REFRIGERATION MECHANICS SPARE TIME COURSE

Learn at home—how to start your own repair shop on little capital. No previous experience needed. Common school education sufficient. Splendid opportunity for older men. Prepare now for after the war. FREE illustrated booklet. MECHANICS TRAINING SCHOOL, Dept. PS, 4701 W. Plea, Los Angeles 6, Calif.

WINDOW SIGN LETTERS

For Store Fronts and Office Windows. Anyone can put them on. Free Samples. Liberal Offer to general agents. METALLIC LETTER CO., 432 N. Clark St., Chicago

PRACTICAL ARC WELDING!



Order your Copy NOW! \$2.00 Post Paid

Here at last is a complete arc welding manual covering every phase of the subject for the beginner and past master alike. Every proper procedure is outlined; diagrams show you exactly how to proceed for the type of metal, position of welding and rods used. A big, full sized book full of valuable information that'll be worth hundreds to you. Hobart Bros. Co., Box M-113, Troy, O.

516 PAGES, 512 ILLUSTRATIONS, NEW techniques, procedures, methods, materials clearly explained. A text book and daily guide for operators on vital war work.

192 page ARC WELDING Lessons Book

Used in Hobart's Famous School. Is a complete outline for a self-instruction or refresher course. Worth many times its low price—Only 75¢

HOBART



or sent on 5 DAYS APPROVAL if you wish.

"One of the World's Largest Builders of Electric Arc Welders."

Monastery Secrets

... THE FORBIDDEN KNOWLEDGE OF TIBET

What strange secrets of nature are locked within the mountain fastness of Tibet? What control over the forces of the Universe do these cloistered sages exercise? For centuries the world has sought to know the source of their power—to know their mastery of life, and their faculty for overcoming problems with which the masses of mankind still struggle. Have they selfishly deprived humanity of these rare teachings?

WRITE FOR THIS FREE BOOK

Like the streams that trickle from the Himalayan heights to the plateaus below, the great truths of these brotherhoods have descended through the ages. One of the preservers of the wisdom of the Orient is the Rosicrucian Brotherhood (not a religious organization). They invite you to write today for their FREE Sealed Book, with its amazing revelations about these mysteries of life. Address: Scribe Y. E. M.

The ROSICRUCIANS
AMONG
San Jose, Calif.
U.S.A.



LAW STUDY AT HOME for PERSONAL SUCCESS and LARGER EARNINGS. 31 years expert instruction—over 106,000 students enrolled. LL.B. Degree awarded. All texts furnished. Easy payments. Send for FREE BOOK—"Law and Executive Guidance."

AMERICAN EXTENSION SCHOOL OF LAW
Dept. 35-M, 8 East Huron St., Chicago, Ill.

WANTED! Men and women to learn following big pay trades in 2 to 8 weeks: Machinist, Auto-Diesel, Refrigeration, Air Conditioning, Welding, Body and Fender, Aviation. We pay room and board. Write us, specifying trade interested in. Established 1902. 41,000 graduates. **GREER SHOP TRAINING**, Dept. 1113, 2017 S. Wabash Ave., Chicago.

FIX ANY RADIO
Amazing New Invention

Simplified Radio Servicing by Comparison Method

Learn quickly to repair all radio sets. New, revolutionary different Comparison method permits you to do expert work almost immediately. No previous radio knowledge required. Introductory training included. Find any fault quickly. Use a screw driver, pliers, and a piece of wire—no testers needed. Simple, point-to-point picture suggestions tell you where to look for faults and how to make the repair. Plan U. S. Copyrighted. Covers every radio set—new and old. You may try the plan for 10 days without any risk.

Easy to Apply
Price only \$1.50, postpaid. In Manual form, 8 1/2 x 11 in. 112 large pages. Data on 346 radio tubes. 16 trouble shooting blue-prints. Over 1,000 time-saving service hints. Developed by M. N. Beitman, noted engineer and author. Order without risk for 10 days use. Write today.

SATISFACTION GUARANTEED
Read the introductory job sheets, follow the step-by-step picture blueprints, and fix any radio in minutes instead of hours. The complete simplified training is yours for only \$1.50, postpaid, 10 days trial. Money back guarantee.

SUPREME PUBLICATIONS
328 S. Jefferson St., Chicago 6, Ill.

FREE OFFER for FALSE TEETH



TIGHTENS FALSE TEETH OR NO COST

Here's new amazing mouth comfort without risking a single cent... enjoy that feeling of having your own teeth again.

JUST 3 STEPS



Satisfy your desire for food... eat what you want. **CROWN RELINER TIGHTENS FALSE TEETH OR NO COST.** Perfect for Partials, Lowers or Uppers.

Don't suffer embarrassment and discomfort caused by loose dental plates. Apply **CROWN RELINER**. In a jiffy your plate fits like new and stays that way up to 4 months. No old-fashioned heating to burn your mouth. Just squeeze **CROWN** from tube and put your teeth back in. They'll fit as snugly as ever. Inventor is a recognized authority in dental field. A patent has been applied for **CROWN RELINER** to protect you from imitators. After you reline your plate with **CROWN**, take your false teeth out for cleaning without affecting the **CROWN RELINER**. **CROWN RELINER** is guaranteed... it's harmless. **NOT A POWDER OR PASTE!** Does Not Burn or Irritate. If not satisfied, even after 4 months, return partly used tube for full refund.

SEND NO MONEY

You must be one hundred percent delighted or no cost. Try it for four months and return for full refund if not satisfied. Order at once and we'll include free with your order a tube of Crown's Dental Plate Cleaner. Rush coupon. Pay postman one dollar for combination plus postage, or send cash and we pay postage. Act now.

READ THIS:

J. Clements of Algona writes: "My plates were so bad they rattled when I talked. Now I can eat steaks, corn on the cob." Reline your plates with **CROWN**. It's tasteless. Has that natural pink color. Order a tube of **CROWN RELINER** today.

Order this this FREE

CROWN PLASTICS CO.
Dept. 2411
4358 W. Philadelphia Ave.
Detroit, Mich.

Send your wonderful Crown Dental Plate Reliner and include the free Crown Dental Cleaner. I will pay postman one dollar plus postage on arrival. If I am not satisfied after four months, I may return partly used tube for full refund.

☐ I am enclosing one dollar in full payment, same guarantee.)

Name.....
Address.....

Say you saw it in Popular Mechanics!

99 Booklets filled with Money and Time-Saving Helps

Little Library of Useful INFORMATION

Here at amazingly low cost is the practical help and information you have always wanted. Articles in previous issues of Popular Mechanics have been classified according to subject and are now available in these handy reprint booklets. Check Titles wanted, clip ad and mail today.

BOOKLETS ON WORKSHOP EQUIPMENT

Power-Driven Saws—74: Complete details on scrollsaw, two circular saws, sliding cut-off saw, bandsaw.
Drill Presses, Plane, Grinders—79.
Sanders—80: Complete constructional details on 8 useful machines.
Wood & Metal-Turning Lathes—81: Two wood lathes, small metal-turning lathe.
Filing Machine, Hacksaw, Cutoff Wheel, Shaper—82.
Metal Lathe Tools You Can Make—101.
Workbenches & Tool Cabinets—47.
Spray Painting—94: Constructing spray guns, compressor, using spray gun.
From Pattern to Casting—81: How to make your own patterns and small castings.

BOOKLETS ON SHARPENING—USING TOOLS

Correct Measurement—108: How to use micrometers, gauges, calipers, etc.
Tool and Saw Sharpening—82.
Using & Sharpening Drills & Wood Bits—90.
Successful Wood Turning—32: All the information you need to master this art.
How to Read Blueprints—71: Tells you how to understand signs, symbols, and lines.
Metal Turning Lathe Kinks—99: Simple homemade tools, time and labor-saving shortcuts you can use.
Operating a Metal Turning Lathe—100.
Heat Treating & Case Hardening—102.
Working with Glass—103: Cutting, drilling, etching, blowing.

ELECTRICAL BOOKLETS

Rebuilding & Servicing Electric Motors—75: Repairing and rewinding a.c. and d.c. motors. Locating trouble. Converting auto generators into 110 v. a. c. motors.
House Wiring—89: All the information you need to do a complete wiring job or install extra outlets.
Electromagnets & Solenoids—44: Designing and building.
Transformer Construction—41: Easy-to-understand instructions for all kinds of transformers.
The Boy Electrician—43: Easy-to-build motors, experiments.
Soldering & Brazing—17.
Arc & Spot Welders—5: Building and operating 110 v. a. c. arc and spot welders.
Treasure Finding—33: Build your own treasure finder and metal locator. Details for both large and small radio types.

ELECTROPLATING BOOKLETS

Electroplating with Copper, Nickel, Chromium, Lead, Zinc, Cadmium—86.
Plating Leather & Other Non-Metallic Objects—Plating with Gold, Silver, Alloys—87.

HOME IMPROVEMENT BOOKLETS

Simple Home Improvements—104: Modernizing; making storm sash, ironing boards, etc.
Building Extra Rooms in Attic—23.
Attractive Basement Playrooms—24.
Lower Your Fuel Cost—31: Practical kinks that will save you hundreds of dollars.
Hanging Wallpaper—38: Tricks of hanging wallpaper, removing old paper, etc.
Curing Leaky Basements—45.
Fitting Home Game Room—55: Construct own game & tennis tables, shuffleboard court, action game, portable playrooms.

Ridding the Home of Insect Pests—107: Exterminating and protecting against moths, flies, termites, mosquitoes, etc.
Built-In Fixtures—78: Step and space-saving kitchen units, built-in beds, corner cabinets, vanities, linen chest.
Constructing Indoor & Outdoor Fireplaces—88: Stone fireplaces, portable mantels, garden fireplaces.

GARDENING BOOKLETS

Backyard Gardening—39: Selecting, planning and getting the best results.
Lawn & Garden Novelties—72: Jig-sawed ornaments, parkway numbers, sundials, flower boxes.
Trellises, Pergolas, Fences—76.
Lawn & Garden Furniture—77: Modern bent-tube furniture, arbor and seat combinations, swings, lawn chairs.
Playground Equipment—73: Two playhouses, ferris wheel, roller coaster, treadmill, play store, slide, two merry-go-rounds.
Colored Concrete Garden Furniture—6: Garden benches, pottery, flower boxes, bird baths and sundial pedestals in colored concrete. How to build small concrete mixer.
Bird Houses—7: Easy to build homes for all kinds of birds.
Farm & Garden Tractors—8: Two tractors you can build from old automobile parts.

CRAFT WORK—HOBBY BOOKLETS

Complete how-to-make-it instructions for hundreds of practical projects.

Working with Plastics—51: Using brilliantly-colored plastics in craftwork.
Magazine Racks—49: Ten attractive racks.
Clock Cases—50: Large Hall, Colonial wall and mantel, ship's wheel, miniature grandfather, desk, Spanish style banjo.
Serving Trays for Every Occasion—53: Fourteen different designs.
Children's Room Furniture—51: Twelve attractive pieces.
Book Ends—52: Ten designs offer good selection.
Small Tables—54: Modern and colonial styling.
Smoking Stands—56: Seven designs given.
Jigsawed Novelties—57: Sewing kits, string holders, place-card holders, plywood kitchenware, plant and flower holders, coin banks, door stops, drawer pulls.
Desks—58: Colonial writing desk, two modern-type desks, student's study desk of plywood, combined chest and writing desk.
Desk Cases—59: Right designs.
Doll House & Doll Furniture—60.
25 Shelves You Can Make—64.
Novelties Turned on Lathe—62.
Inlay Pictures—Veneering—63.
Whittling and Wood & Soap Carving—65.
Action Toys—66: 21 easy-to-make toys.
High Flying Kites—67.
Windmills & Weather-vanes—68.
Lamps in Wood, Metal, Plastic—69: Selection of 14 designs.
Home Work Opportunities—19: Simple handicraft with money-making possibilities.
Telescopes—20: Reflecting telescopes you can build for less than \$10.00.
Metal Craft—28: Brass tapping and making of novelties both decorative and useful.
Small Looms—37: Building hand looms for weaving rugs, etc.; leather novelties.
Plain & Novelty Wood Finishing—40.
Gem Cutting—42: How to cut and polish semi-precious stones.

5 for \$1.00
12 for \$2.00
25¢ Each

BOAT BUILDING BOOKLETS

Build a boat at home—you can do it

14 Ft. Outboard Runabout—3: Here is a fast 14 foot V-bottom boat. Suitable for motors of 4 to 24 hp., estimated cost, \$30 to \$40.
14 Ft. Sailing Dinghy—26: This 14-foot boat combines strength and light weight. It carries 140 sq. ft. of canvas and weighs about 350 pounds. Actual photographs and diagrams illustrate every detail.
21 Ft. Sloop—46: Every fact needed by the amateur boat builder to construct this craft which carries eight to ten persons.
Rowboats, Bicycle Boat, Small Dinghy—83: All the information you need to construct four low-cost boats.
Small Sail Boats—94: 12-ft. sailing dinghy, 8-ft. "training ship" for young sailors, how to sail a boat.
Two Outboard Runabouts—85: 14-ft. family outboard weighs about 400 lbs. and 12-ft. plywood outboard weighs about 110 lbs. Both are V-bottom type.
Build Your Own Canoe, Kayak, Surfboard—30: Complete details on 10-ft. Canadian-type canoe, 17-ft. kayak, and 12-ft. hollow surfboard.
Fast Class-E Ice Yacht—22: Build your own Class-E ice yacht. Every detail of construction carefully explained.

AUTOMOBILE BOOKLETS

Automobile Kinks and Shortcuts—10: Money-saving hints on upkeep and operation.
Building Trailers—27: Small Streamlined house trailer; several utility trailers.
Motor-Driven Midget Car & Scooter—34: Both use gas engine of washing machine type.
Curing Auto Electrical Troubles—95.

PHOTOGRAPHY BOOKLETS

Save Money by constructing your own photo equipment.

Photo Enlargers—1: Condenser lens type; Simple vertical; horizontal.
Photo Printers & Dryer—25: Describes three practical printers, timer and negative dryer.
Photo Darkroom Equipment—86: Cabinets, light-tight box, timer, agitator, washer, trimmer.
Picture Projector, Trick & Table Top Photography—97: Projectors that enlarge magazine illustrations and shop drawings. Tips for table toppers, photomontages, tricks.
Photo Kinks—98: 63 time and money-saving ideas you can use.

FORMULA BOOKLETS

Transform simple ingredients into useful products

Cleaning Preparations—11: Easy-to-make cleaners for walls, glass, etc. Removing fabric stains.
Cosmetic Formulas—12: Hand lotions, creams, rouge, bath salts, beauty clay, lipsticks, etc.
Metal Plating & Coloring—21: Dozens of formulas for metal plating, coloring and decorating.
Re-Silvering Mirrors—70: Formulas for silvering and coloring.

MISCELLANEOUS BOOKLETS

Chemical Experiments—83: Easy-to-perform experiments. Inexpensive lab.
Taxidermy—9: How to prepare skins and obtain life-like poses.
Log Cabins & Tourists Cottages—14: Year-round log cabins; inexpensive tourists' cabin.
Magic for Everybody—29: Simple tricks to puzzle your friends.
Trapping Small Animals—33: How to lure fur beasts, prepare bait and traps, dress skins.
Tricks of Training Your Dog—35.
Small Furnaces—36: Build own gas or electric.

Books Sent C.O.D. Anywhere in United States

Just check the booklets you want (minimum C.O.D. order \$1.00), write your name and address below, and mail this advertisement. It is your order blank. When postman hands you booklets, pay him the price and few cents postage. Outside U. S. A. enclose remittance and include 15% additional for shipping charges. Ask for big FREE catalog of helpful books.
(If you send payment with order we pay postage. U. S. currency or stamps may be mailed if carefully wrapped. Money-back guarantee)

Name
City State
Address

Mail to Popular Mechanics Press, Dept. 493—200 East Ontario St., Chicago, Ill.

FREE! LATEST, MOST COMPLETE RADIO PARTS CATALOG



**EVERYTHING in RADIO and
ELECTRONICS for War Train-
ing, Maintenance or Repair**

It's the most complete, up-to-date **BUYING GUIDE** available! It contains latest "supply data" on radio and electronic parts available without priority for repair and replacement—*plus* everything in war training kits, books and equipment! Whatever you need—you'll save time by getting in touch with **ALLIED first**. Send for this big free catalog today.

RADIO'S FINEST BOOK VALUES

Specially prepared to aid radio training in schools and industry. Full of valuable data. Send for all six!

Radio Formulas and Data Book No. 37-752...10c

Dictionary of Radio Terms No. 37-751...10c

Radio Circuit Handbook No. 37-753...10c

Radio Builders' Handbook No. 37-750...10c

Simplified Radio Servicing No. 37-755...10c

Radio Data Handbook No. 37-754...25c

All Six Books No. 37-799...75c

ALLIED RADIO CORP.


833 W. Jackson, Dept. 5-L-3, Chicago

ALLIED RADIO

RADIO

ENGINEERING, Broadcasting, Servicing, Electronics, Aviation, Marine & Police Radio taught thoroughly. 48 weeks' Engineering course equivalent to 3 years' college radio work. School established 1874; all expenses low. Co-educational. Catalog free.

Dodge Institute, Dept. D, Valparaiso, Ind.



Class Pins and Rings


Artistic pins, rings and emblems. Finest quality. Reasonable prices from 55c up. Write today. Dept. N.

Metal Arts Co., Rochester, N. Y.

FREE
Catalog

Always write your name and full address clearly when answering advertisements.

BUILD a BOAT



**FOR PLEASURE OR PROFIT
DESCRIBES 17 LOW COST BOATS**

Get this outstanding book and build a boat at home for your own use or to sell at a profit. You can do it. Just the boat you've always wanted—power, sail or row boat—17 different kinds and sizes.

Order **BUILD A BOAT** on postal card and pay only \$1.50 plus postage on delivery. Return in 5 days if not pleased and get money back. Or send \$1.50 with order. (Outside U. S. \$1.70 with order.) Order today.

POPULAR MECHANICS PRESS
Dept. 455, 280 E. Ontario St., Chicago

Row Boat—12 Foot
Dinghy—8 Foot
Dinghy—14 Foot Sailing
Training Ship—6 Foot
Sea Sled—3 Foot
Outboard—12 Foot
Cruiser—18 Foot
Bicycle Boat—Sectional
Row Boat—Sailing
Dinghy—16 Foot
Canoe—12 Foot
Sailing—12 Foot
Outboard—12 Foot
Pentagon—Ice Yacht

Say you saw it in Popular Mechanics!

10 INCH SLIDE RULE FREE

With Complete and Simple Instructions for use!

Magnifying Indicator in genuine LUCITE. Scales A-B-C-D and K.



**Anyone
Can Learn**

Don't let Slide Rule scare you. Learn in few hours to do lightning calculations. Divide, multiply, find ratios, percentages, squares, areas, etc. Send name on coupon below for this wonderful course of instruction "The Slide Rule and How To Use It" and get the 10 inch Slide Rule **FREE** with your course. Full price for course and Slide Rule both, only \$2.98. Limited quantity! Rush your order!



WILCOX & FOLLETT CO.,

Dept. 211, 1255 S. Wabash Ave., Chicago (5) Ill.

WILCOX & FOLLETT, Dept. 211

1255 S. Wabash, Chicago (5) Ill.

Mail the new "Slide Rule and How to Use It" including work sheets, answer book, and 10" Mannheim Type Slide Rule with Lucite Magnifying Indicator, all in one cover.

☐ I enclose remittance in full for \$2.98.

☐ Ship COD. I will pay postman \$2.98, plus charges.

Name

Address

City

State

7 Days FREE TRIAL -Costs You Nothing to Examine Amazing New 3 Vol. set of REFERENCE BOOKS on PRACTICAL

ELECTRICITY

At Last! A set of Electrical Books in plain language for "beginner" or "old timer." Solves everyday electrical problems quickly!

SEND NO MONEY!

Now at last it's easy to get a knowledge of Electricity AT HOME. Whether you want to learn Electricity or are now doing electrical work you need these books.

Authoritative, practical. Prepared by experts. Covers everything Electrical. Hundreds of pictures, diagrams. Used on the job by many Electricians.

EXAMINE FREE 7 DAYS

Coupon brings all 3 volumes postpaid. See this amazing set, then decide. Act NOW!

**H. C. LEWIS, Pres. Dept. 83-RG
COYNE ELECTRICAL SCHOOL
500 S. Paulina St., Chicago, Ill.**

Send me the big 3-volume Coyne Electrical and Radio Reference Encyclopedia, postpaid, and 100 Shop Prints FREE. Within 7 days after receiving books, I'll either return them or send you \$1.00 and \$3 a month until advertised price of \$15.95 is paid.

NAME

ADDRESS

CITY

STATE

OCCUPATION

AGE

SAVE 10%. Send cash price, \$12.55, with order, if preferred—you save \$1.40. Same 7-day free trial and return privilege.



A message for you . . . from 1953

(Today, John Jones is just an average American, wrestling with all the doubts and worries and problems that beset every one of us right now. But let's skip ahead 10 years. Let's look at John Jones then—and listen to him . . .)

"SOMETIMES I feel so good it almost scares me.

"This house—I wouldn't swap a shingle off its roof for any other house on earth. This little valley, with the pond down in the hollow at the back, is the spot I like best in all the world.

"And they're mine. I own 'em. Nobody can take 'em away from me.

"I've got a little money coming in, regularly. Not much—but enough. And I tell you, when you can go to bed every night with nothing on your mind except the fun you're going to have tomorrow—that's as near Heaven as a man gets on this earth!

"It wasn't always so.

"Back in '43—that was our second year of war, when we were really getting into it—I needed cash. Taxes were tough,

and then Ellen got sick. Like most everybody else, I was buying War Bonds through the Payroll Plan—and I figured on cashing some of them in. But sick as she was, it was Ellen who talked me out of it.

" 'Don't do it, John!' she said. 'Please don't! For the first time in our lives, we're really saving money. It's wonderful to know that every single payday we have more money put aside! John, if we can only keep up this saving, think what it can mean! Maybe someday you won't have to work. Maybe we can own a home. And oh, how good it would feel to know that we need never worry about money when we're old!'

"Well, even after she got better, I stayed away from the weekly poker game—quit dropping a little cash at the hot spots now and then—gave up some of the things a man feels he has a right to. We made clothes do—cut out fancy foods. We didn't have as much fun for a while but we paid our taxes and the doctor and—we didn't touch the War Bonds.

"We didn't touch the War Bonds then, or any other time. And I know this: The world wouldn't be such a swell place today if we had!"

★ The Treasury Department acknowledges with appreciation
the publication of this advertisement by ★

POPULAR MECHANICS MAGAZINE



THIS VALUABLE BOOK

FREE

LEARN CARTOONING AT HOME IN SPARE TIME

Send for this FREE book containing money-making tips, cartooning charts, idea creating methods, list of cartoon buyers, and other valuable information. Read about the money-making opportunities in one of the most fascinating of all professions—CARTOONING. With this booklet we will include a complete portfolio describing our easy Course in Cartooning and explaining our new Marionette Method of Instruction. We will also tell you how to get the Cartoonists' Exchange Laugh Finder FREE of extra cost. This amazing device actually helps create and originate humorous ideas. Send name at once and mention your age.

CARTOONISTS' EXCHANGE

Dept. 911,

Pleasant Hill, Ohio

PROFITABLE MANUFACTURING AND SALES COOPERATION FOR YOUR POST-WAR PRODUCT OR INVENTION

Looking for cooperation in post-war manufacture and marketing of metal or wood products that can be sold to sporting goods and hardware jobbers? Manufacturing and sales rights to such articles are sought by the largest manufacturer—rated AAI—of an important item sold through these channels. Modern equipment and skilled personnel offer you ample production facilities. Well established contacts will speed success of sound invention or new product. Write for interview or further information. Briefly describe your product in reply. P. O. BOX 1297-A, LANCASTER, PA.



GERSTNER TOOL CHESTS

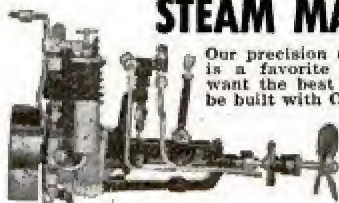
are designed to give complete protection to fine tools. Free catalog to toolmakers and machinists.

GERSTNER TOOL CHESTS

443 Columbia St.,

Dayton, Ohio

STEAM MARINE ENGINE



Our precision one cylinder Marine Engine is a favorite with Model Builders who want the best in Engineering Design. May be built with Clutch or Reverse gear. Has oil and water pump with automatic return feed and operating valves. Not a Toy but an Engineered model operating at pressures comparable to the most Modern Marine Construction. Scale 1/4" to 1 inch. 11 1/2" overall, 6 1/4" high, 4" wide. Send \$2.50 for eleven pages of scale drawings including boiler layout and two actual photographs, or 25c for photograph showing two views including boiler. Sets available of rough or semi-finished castings. Completed shop tested engines available.

The Thompson Engineering Co., Dept. B-11, Grand Rapids 2, Mich.

Anyone Can Build.. ARC WELDERS with these Plans

WE

SHOW YOU HOW

Here are six plans that will enable you save money on your own welding and to make money on outside jobs. On top of that, a knowledge of welding is a valuable asset anywhere.

Plan 8: Arc Welder from old auto generator, Single or dual, hook up output 75 to 200 amps.

Plan 29: Portable transformer Arc Welder for use on 110 or 220 A.C. Output 80 to 125 amps.

Plan 50: Transformer Arc Welder for use on 110 or 220 A.C. Has 16 different heats, 75-85 amperes. No rewinding necessary. Uses coils taken from old auto generator.

Plan 30: Spot Welder capable of welding up to 1/2" for operations on 110 A.C.

Plan 32: Spot Welder for handling light sheet metals. Operates on car battery. Simple to build.

Plan 46: Carbon electrode welder for light welding, brazing and soldering. Operates on car battery.

PLANS SIMPLE—NO EXPERIENCE NEEDED

All details clearly shown and described; no hard work or previous experience required for a perfect job. Our valuable Catalog of 1,000 Electrical Supply Bargains will be sent FREE with plans.

Send only \$1.25 for complete set of 6 Plans and get started on a fascinating and money-making project.

Total value of plans, if purchased separately, \$1.85

**6 PLANS
Only
\$1.25**

**LEJAY
MANUFACTURING COMP.**

2347 LeJay Building
Minneapolis 8, Minn.



ARC WELDING

Pays Big!

The HOBART School is a Non-Profit Institution Founded to furnish industry with trained operators and to further the interests of arc welding, the Hobart School from the beginning has been operating on a basis of the students sharing in material costs only.

Nevertheless, the Hobart Course is an intensive one, designed to prepare you for a big-pay job as soon as you graduate. Individual booths, welders, let you get the most from the course. Learn the Hobart way for bigger pay. Write for Further Details

HOBART TRAINS YOU IN SIX WEEKS. A BIG demand for welders will continue after the war... Start now! Costs little

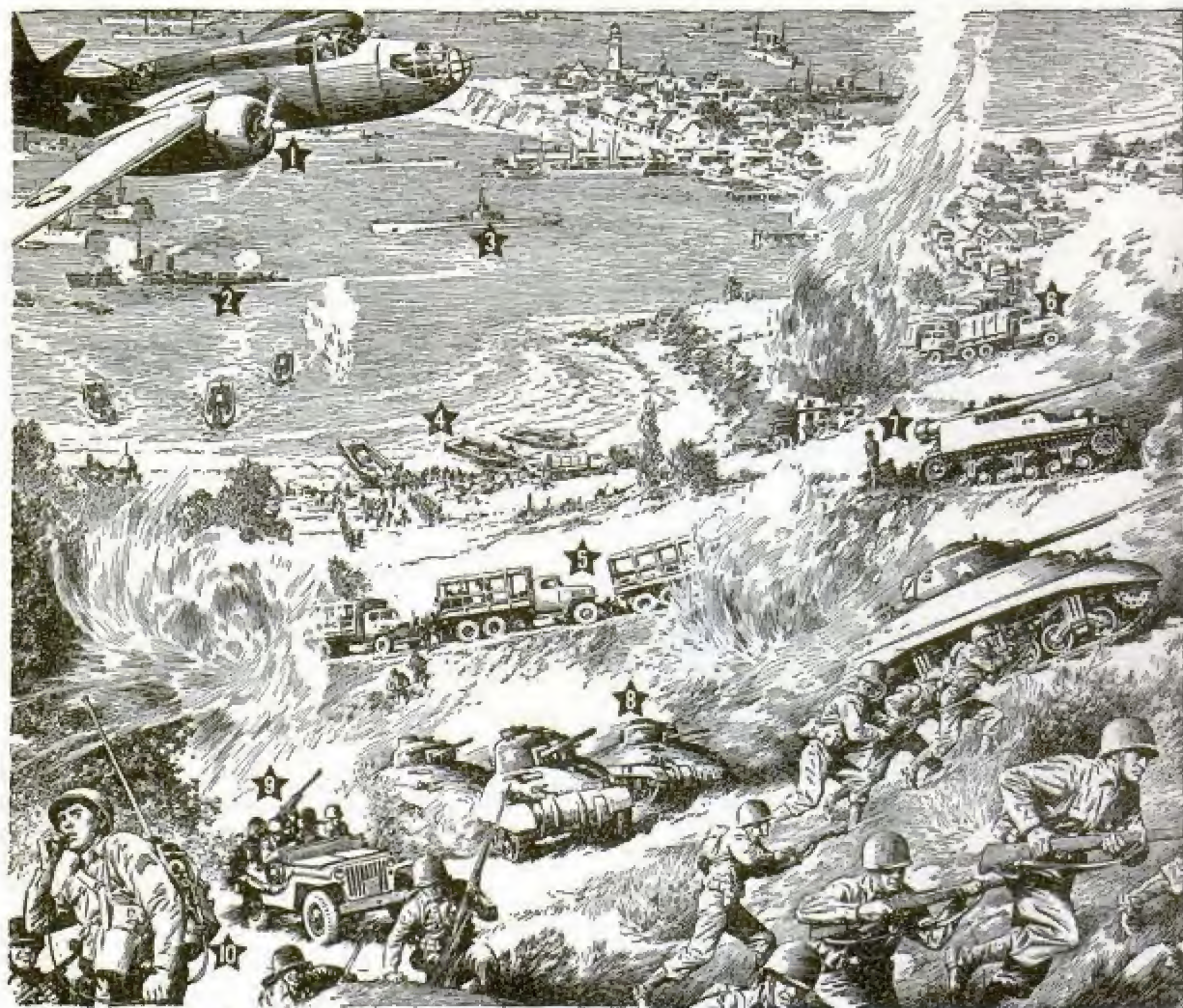
HOBART
One of the World's Largest Builders of Arc Welders

HOBART

SCHOOL OF ARC WELDING, Box M1131, TROY, OHIO

FREE booklet on courses, offers suggestions and schedules

Without batteries...war machines are useless!



1. Bomber 2. Destroyer 3. Submarine 4. Landing Barges 5. Troop Transport Trucks 6. Supply Trucks
7. Self-propelled 155 mm. Gun 8. Tanks 9. Jeep 10. "Walkie-talkie" communications

EXIDE BATTERIES ARE USED IN MORE THAN 100 APPLICATIONS BY OUR ARMED FORCES

Modern mechanized warfare demands a dependable source of electric power, which, under most conditions, only a storage battery can supply. Without such a source of power, our mightiest weapons would lie useless, idle, dead.

Supplying dependable storage batteries to the armed forces is Exide's most important present day job, and you as a civilian motorist can help us provide America's fighters with more and more of them. You can do this by giving your present battery the very best of care. Let your Exide Dealer check your bat-

tery every two weeks. Trust him, and his dependable Exide Sure-Start Service, to prolong its useful life.

Remember, when you take care of things you own, you're really making important savings. Invest your savings in War Bonds.

Back the attack—with War Bonds!



WHEN IT'S AN EXIDE YOU START

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia • Exide Batteries of Canada, Limited, Toronto

Mr. Whittaker

Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE AND CANADA

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 80

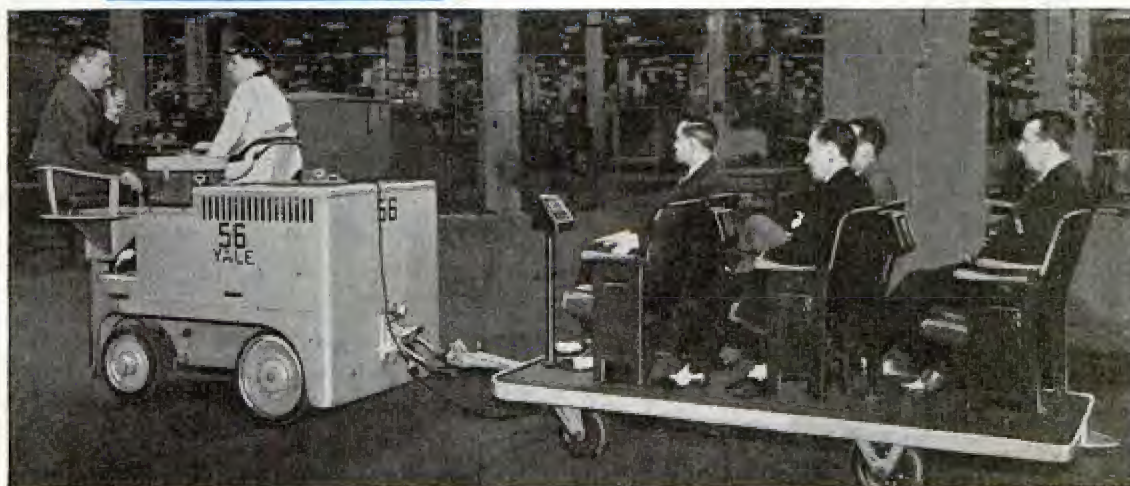
NOVEMBER, 1943

No. 5

HITLER'S 500-ACRE HEADACHE



Night construction scene at vast Dodge Chicago plant. Below, trailer hauls official visitors—note the microphone



By Wayne Whittaker

MOVE over Willow Run, Pentagon Building, Merchandise Mart, and Boulder Dam. Make way for Uncle Sam's giant war baby and Hitler's latest headache—the Dodge Chicago Plant, Division of Chrysler Corporation. It's the world's largest airplane engine factory, and about to move along its assembly lines are some of the world's most powerful bomber motors.

One building in the immense plant covers some 80 acres of ground, or about 50

city blocks. Nothing like it has ever been constructed. Experienced automotive and aeronautical executives, who are used to doing big things in a big way, are literally flabbergasted by its size, by the thousands of shining machine tools arrayed under a concrete roof that seems as big as the sky.

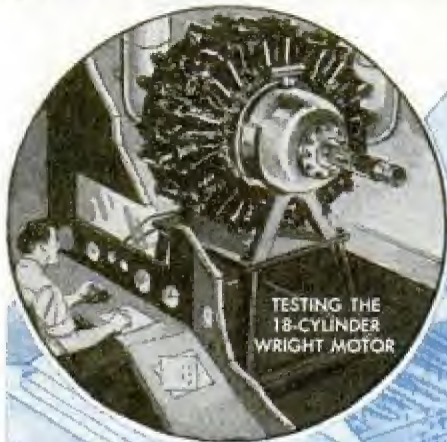
The only way you can see clearly from one end of the main building to the other is with a pair of binoculars. This mammoth one-story structure, the queen of nearly a

score of buildings sprawled over 500 acres, could swallow the Ford Willow Run bomber plant and leave room for 20 baseball diamonds around the edge. It has more floor space than either the War Department's Pentagon Building or Chicago's Merchandise Mart. And when the plant reaches maximum production its weekly output of engines will be tremendous.

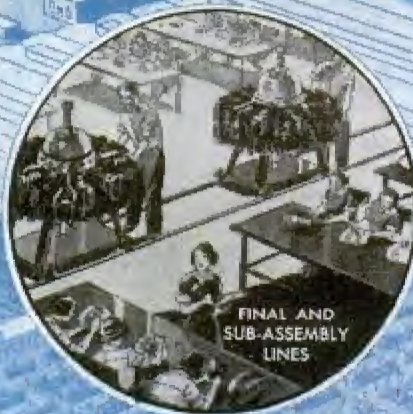
The great bombers for which these engines are designed are the No. 1 U. S. military secret. But anyone can guess that they are the ships to which Gen. Henry H. Arnold referred when he spoke of the Flying Fortress as "the last of the small bombers." And anyone can guess that the new Wright engine made in the Dodge Chicago Plant—it has 18 cylinders and considerably more than 2,000 horsepower—will enable bombers to carry



WORLD'S MOST POWERFUL
AIRPLANE ENGINE TO BE
BUILT IN 500-ACRE
DODGE CHICAGO PLANT



TESTING THE
18-CYLINDER
WRIGHT MOTOR



FINAL AND
SUB-ASSEMBLY
LINES

ASSEMBLY ROOM

LUNCH ROOM

LOCKERS AND
WASHROOMS

CAFETERIA

ADMINISTRATION
BUILDING



THIS HUGE
COFFEE POT
IN PLANT
KITCHEN
HOLDS 125
GALLONS—
2,000 CUPS

record loads of block busters on round trips from American bases to Berlin and Tokyo.

That is why the plant producing these engines is regarded as the most important war industry in America today. It also explains why much of the activity in the plant, which is financed by the Defense Plant Corporation and operated by the Chrysler Corporation, is shrouded in secrecy.



SAND MOLD FOR ALUMINUM CASTING



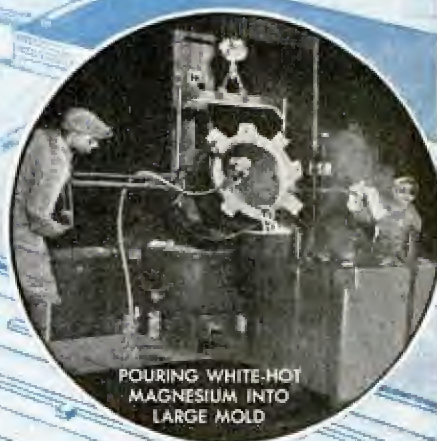
FORGING—FIRST STEP IN CONVERTING RAW STEEL ALLOY INTO FINISHED PART

WATER RESERVOIR FORGE SHOPS

300,000-TON COAL PILE

ALUMINUM AND MAGNESIUM FOUNDRIES

FORGINGS AND MOLDED PARTS HAULED TO MAIN BUILDING FOR FINISHING



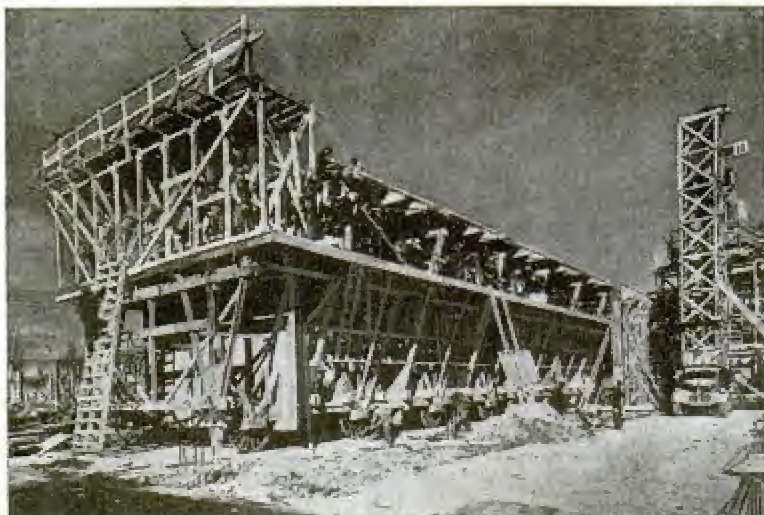
POURING WHITE-HOT MAGNESIUM INTO LARGE MOLD

THOUSANDS OF LATHES, DRILLING AND MILLING MACHINES

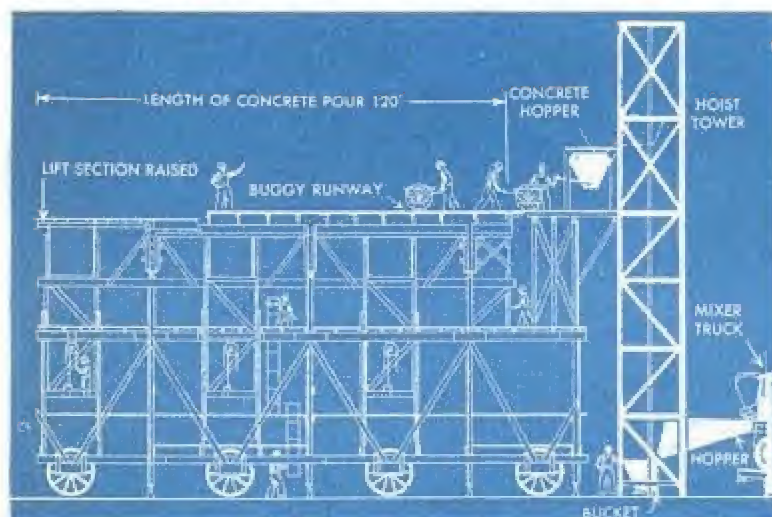


MACHINING ENGINE PARTS TO MEET EXACTING SPECIFICATIONS

PARKING LOT 1 BLOCK WIDE 1 MILE LONG



One of 60 portable concrete forms used to pour sections of main building that covers 80 acres. Diagram (below) shows how the form operates



Many areas in the place are blocked off with letters a foot high: RESTRICTED.

But it can be told that this vast plant, enclosed by four miles of fence, will take in raw bars of steel, pigs of aluminum and magnesium at one end and turn out finished motors at the other. It is the only airplane engine plant in the world that will do this. When the engines take their final leave of the testing cells they will be ready for flight.

In construction alone, so many records were broken that Chrysler engineers long ago gave up keeping tab on them. The first ground was broken June 4, 1942. In 12 months all the buildings were completed, and in 14 months many were already in production. During the height of day-and-night construction activity, 150 carloads of sand, cement and stone were brought into the plant every day. In addition, 800 truck loads of building material were used daily.

At one time there were more than 16,000 workmen and some 1,400 engineers on the job.

A new and speedy type of construction was used for the buildings which are of reinforced concrete with a roofing of concrete slabs. Even the building arches are concrete. Sixty portable concrete forms, resembling Helen of Troy's wooden horse, were used to pour the main building. They moved on wheels as the concrete work progressed along the length of the huge structure. The concrete was hoisted up towers and transported in "buggies." The amount of lumber in the forms would have built 2,000 four-room bungalows.

"With this method of construction, we didn't have to stop after covering 80 acres," one engineer said. "We could have kept right on going across the country."

After the concrete was poured in one section, vacuum pumps sucked water from the cement so that in three to seven minutes the concrete would support the weight of a man. When the section was set, the form was

whisked away to a new position in just eight minutes. The amount of concrete, used in the construction would make a solid block 100 feet square and taller than

Messenger car speeds work orders around the plant



the Empire State Building.

This type of construction required only one-half the normal amount of reinforcing steel, saving enough of that precious metal to build 14 destroyers and about 600 M-4 tanks.

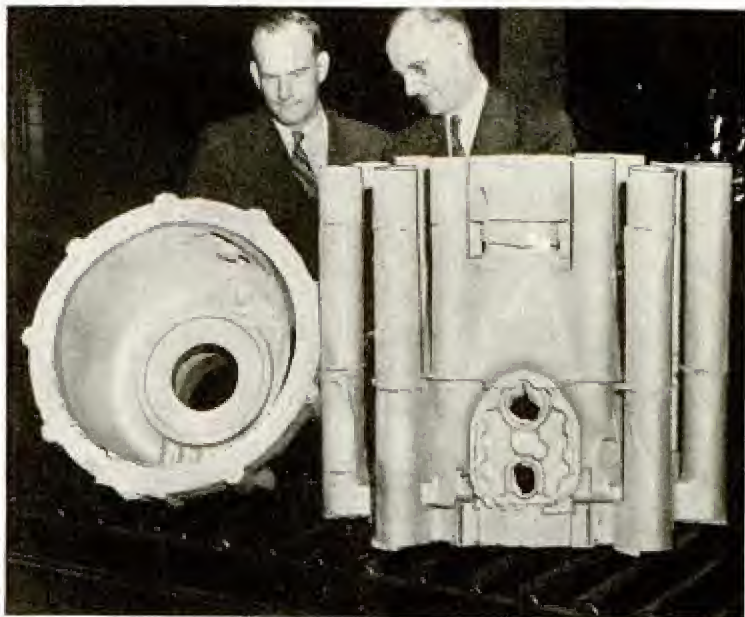
The principal units of the plant consist of the main building where the engines are machined and assembled; two large foundries, one for aluminum, the other magnesium; light and heavy forge shops, heat treating and die shop, testing buildings, tool shop, and an H-shaped, brick-faced administration building. The latter is the only two-story structure at the plant.

Parking lots accommodate more than 13,000 automobiles. The largest is a block wide and a mile long and situated in such a way as to expedite entrance or exit of thousands of employees at one time. Subways beneath the building speed pedestrian traffic. One busy subway intersection is called "42nd and Broadway." Opening off the subway are neat washrooms, miles of locker space, and 9 model cafeterias that will seat 5,000 workers at one time. There is a total of 14 cafeterias in the plant.

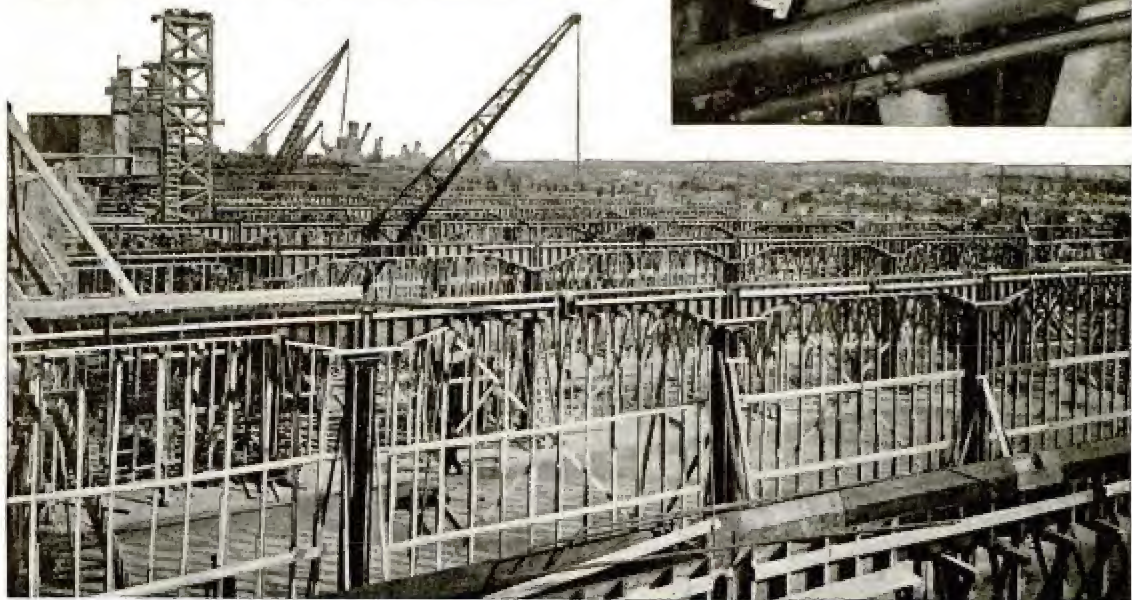
Two immense water towers, made of concrete with cypress tanks to save steel, provide facilities for water lines, while a reservoir holds nearly 3,000,000 gallons. The plant affords enough sewerage, gas and electrical service for a city of

(Continued to page 160)

Hoisting slabs of asbestos coating (right) to cover miles of pipe. Below, skeleton of plant two months after start

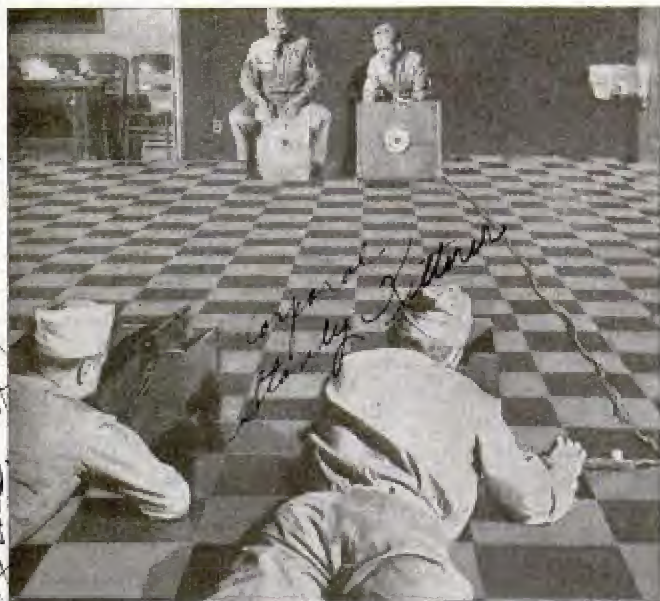


Inspecting world's largest magnesium casting. Risers are still on the one at the right

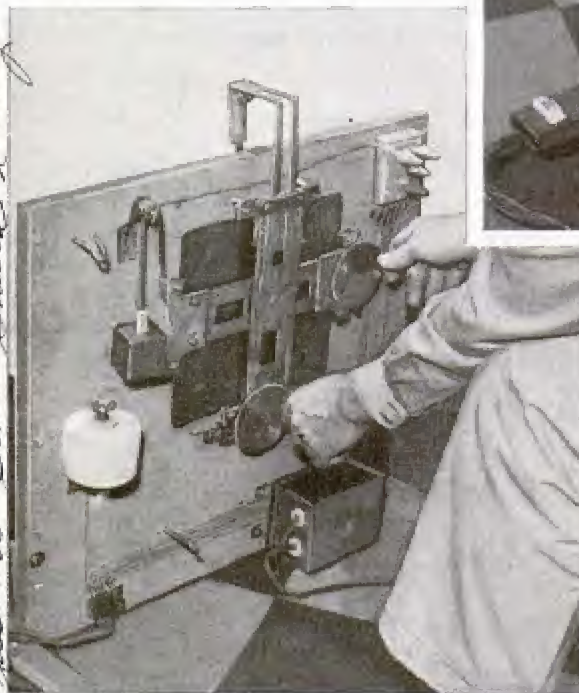
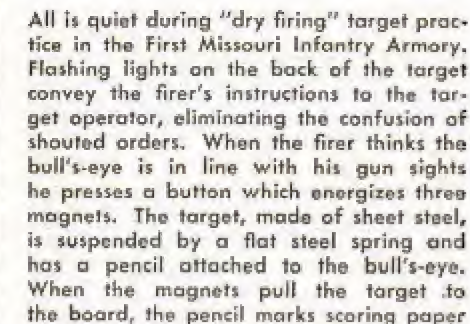


Market Blvd.,
St. Louis, Mo. to Cal. C. A. H. Heyday

Magnet Marker Scores on "Dry Firing" Target



Above, the old system (left) and the new (right). With the new semi-automatic system the marking is entirely controlled by the firer. His accuracy is determined by number of marks made in a one-half inch circle. Right, operating control buttons



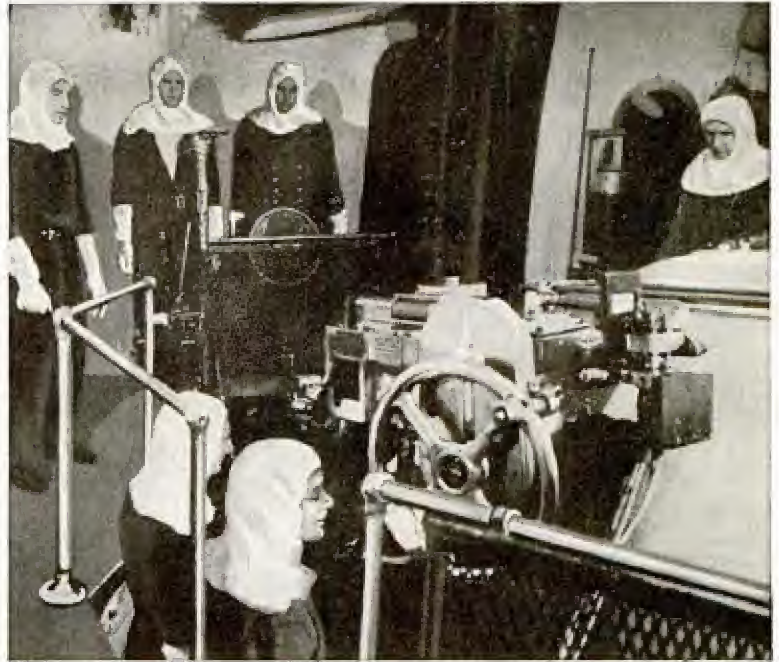
Lights in upper right hand corner on back of plywood target board tell operator direction in which to move target. Center mechanism consists of steel plate with cross pieces for suspending target and gears for moving it. Note roll of paper for marking. Right, Corp. Stanley J. Ketterer, Missouri State Guardsman, the inventor, shows paper used to record score



Gunners in Ship Turrets Wear Asbestos Suits N 472

When the order to man the battle stations is given on board the 30,000-ton British battleship Malaya, turret gunners quickly don their asbestos suits. These suits, which include hood and gloves, give the gunners the appearance of bewigged English jurists. They afford protection against a sudden flashback of fire from the 15-inch guns.

On the British battleship Malaya, gunners in the turrets wear protecting suits and hoods made of asbestos. They come in handy during fiery flashbacks of the big cannon



Arctic Tractor Has Buggy Top for Comfort at 40 Below N 448

Especially equipped for work at 40-below temperatures, a Ford tractor is light of

weight and equipped with a hydraulically operated angledozer, a contrivance similar

to a snowplow, for leveling runways and removing snow. Its equipment includes a dig-and-carry scraper, a large crawler truck, and a mount on the rear to accommodate a 200-ampere arc welder, drawing its power from a take-off shaft through a V-belt. For operation in extreme cold, the crankcase was ventilated to get rid of water and condensed vapors. Spark plugs were raised half an inch, and run out of the cylinder on a riser so they could contact the cylinder through a small hole and not foul.



Angledozer on front of tractor is used to level runway or remove snow

Lavish Lighting in Future Home at Only One-Tenth of Today's Cost N 564

Electric light will be used lavishly in homes 30 years hence, and will cost only a tenth of what it does today, in the view of Ward Harrison of the General Electric Company. Future building designs will emphasize light itself, rather than lighting fixtures, as part of the whole construction plan. Conquering glare and heat are two probable eventualities. As a gauge of future progress, a 100-watt lamp of today

gives five times the light of a lamp of the same wattage in 1913, and at one-half the cost of the current. Best current source of artificial light, the fluorescent lamp, is less than one-quarter efficient, and its improvement will mean more and better light. Maintenance of candlepower and elimination of the starters which are now used on all fluorescent lamps are two refinements to be expected in the future.

7 and 8 years Bureau
3000 Schenectady
Schenectady, N.Y.

Designed for operation
Sir Hubert Wilkins, U.S. Army

AIRLINE to ANYWHERE



A truck with elevating platform lifts cargo aboard a Curtiss "Commando" at an Air Transport Command station

By Roderick M. Grant

FROM half a world away an SOS crackled into U. S. Army headquarters in Washington. General Douglas MacArthur was in critical need of two tons of emergency parts in Australia.

Within a matter of minutes the Army Service Forces had located a source of the essential materiel.

Minutes later a pilot of the Air Transport Command, flying on a routine freight run between St. Louis and San Antonio, picked up an urgent call on his radio. It was midnight. He turned his plane around, headed for another city off his regular route, downed his cargo there and picked up the urgent shipment for General MacArthur.

Next morning his "special delivery" package for MacArthur was delivered at a west coast airport. Forty-eight hours later the two tons of emergency parts were set down in Australia.

Another pilot was forced to cancel a luncheon date in Washington.

"Sorry, fellow," he said, "I've got to be back in Burma in two days."

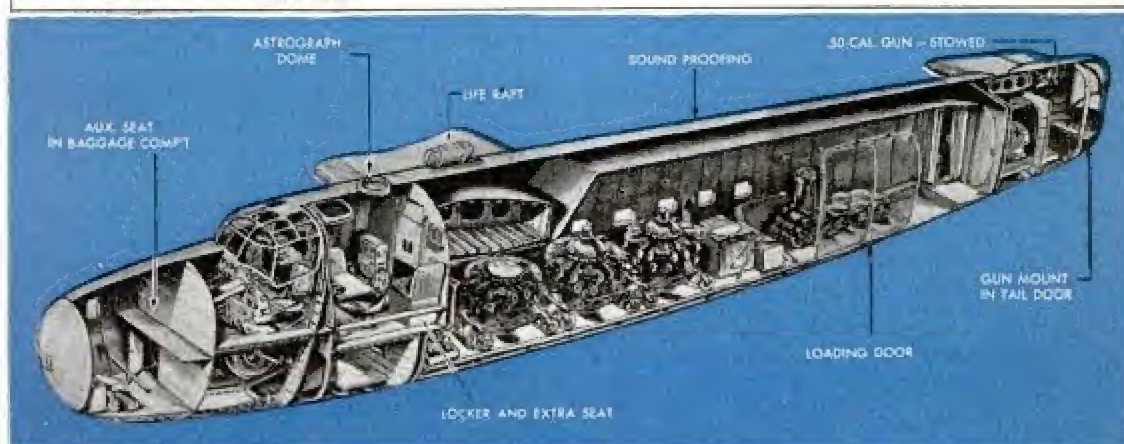
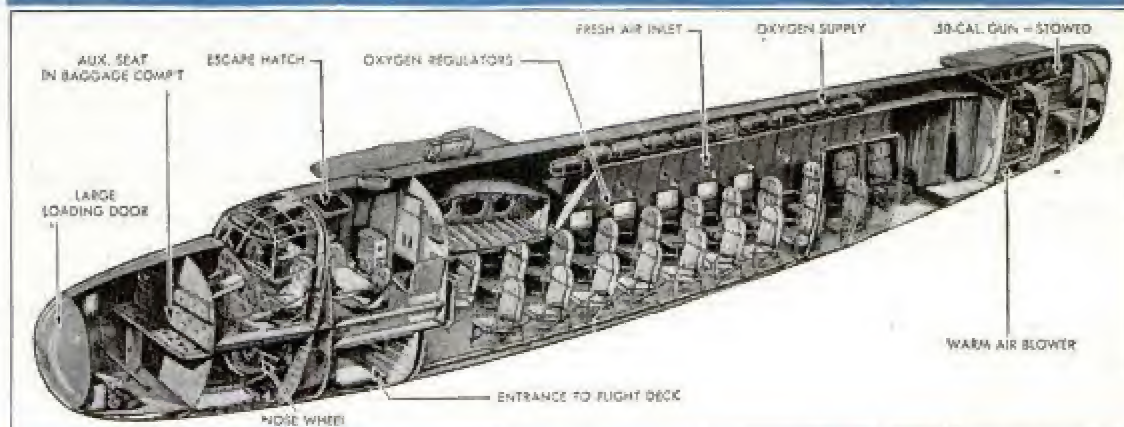
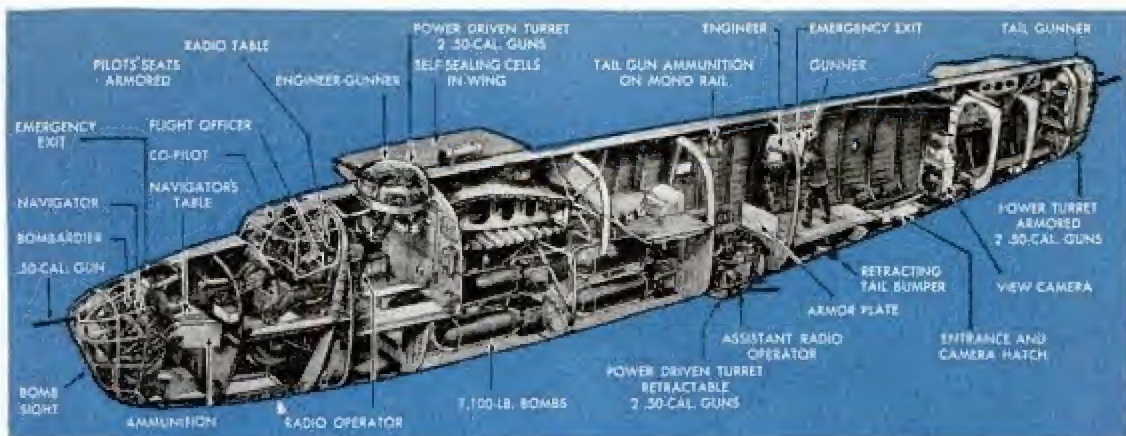
The Air Transport Command is the air line to everywhere. Just a little over a year old, this prodigious baby has far outstripped

its big brother, the U. S. commercial air lines, which are manning some of the ATC routes to Alaska and South America and across the South Atlantic and the South Pacific. Army air transport planes fly 90,000 miles of scheduled air lines.

"I can't tell you how many planes are



Quick return of Yankee wounded in ATC ambulance planes has saved many lives



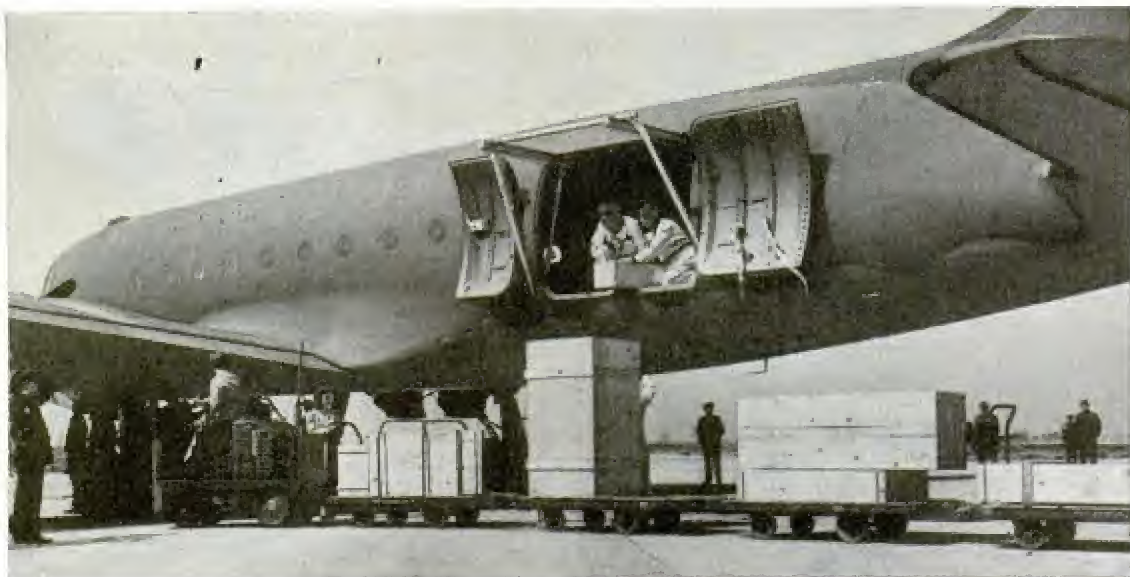
Cutaway drawings depict the Consolidated Liberator as B-24 bomber, as troop carrier and C-87 cargo carrier

shuttling back and forth over these routes," says Maj. Gen. Harold Lee George, Chief of the Air Transport Command, "but a year ago we counted them by scores and today we count them by thousands. In the ATC alone we have more officers today than the entire U. S. Army had before this war began."

Before its worldwide cargo service was established, the ATC already had a year's experience in delivering military planes from factory to training field, to modification center, and on to fighting fronts throughout the world. In the year ended last April, ferry pilots ran up a score of

80,100,000 plane miles. Bomber and fighter planes headed for the skies of Europe and Asia and the Aleutians are delivered from American factories to the Air Transport Command's Caribbean Wing, North Atlantic Wing, Pacific, Alaskan, European, South Atlantic, Africa-Middle East and other Wings.

The freight that flies around the world is weird and wonderful. Movies and mail for the boys in New Guinea. Tungsten from far away places, balsa from Central America to build gliders and mosquito boats in the United States; 20 tons of rubber seeds from Liberia, \$475,000 worth of platinum



A trailer-train rolls freight to the cargo door of Douglas C-54A "Skymaster," which has a hoist for loading

from the Persian Gulf; silk stockings and soft drinks and wounded Yankees.

British factories were running short of mica for aircraft instruments. Within three or four days after the appeal came to the U. S. Air Transport Command, mica from India was delivered in England and the stoppage of work in the aircraft plants was averted. A new freighter faced a delay in port at Seattle for want of 15,000 pounds of copper tubing. A Waterbury, Conn., factory was called upon to produce the stuff, the first ton of tubing was delivered at LaGuardia field, New York, a day later, and within four days—a day ahead of deadline—two commercial air liners and eight ATC planes had delivered the entire shipment in Seattle without interfering with any high priority cargo or passengers.

An army hospital at Nome, Alaska, was destroyed by fire. Two days later two ATC

planes dropped in with a complete 24-bed hospital, X-ray, hypodermics and all. In another emergency an entire sawmill was ferried to the far north. When a 1,200-gallon gasoline truck was needed up the Alaska highway, welders cut it in three pieces, loaded it into an air freighter, and flew north with the truck to reweld it for immediate use at the scene of operations.

Jump-off bases are a closely guarded secret, but from London came a broadcast telling of the "biggest airfield in the world" in Labrador, from which warplanes take off for England. In one 24-hour period, the broadcast said, it serviced more than 100 planes and sent them overseas. In an area favored by good weather the year around, the field may become a great junction for transatlantic air travel after the war.

Weather being, of course, a vital factor in air transportation, the Air Transport

Huge tractor-drawn gasoline tankers are kept busy fueling the transports for long hops



Command has set up its own weather forecasting service on a global scale. Observers from the equator to the arctic and antarctic radio their meteorological data at frequent intervals. Some of them are isolated for nine months of the year. One group of observers reached their post in a desolate arctic spot last Oct. 15. The next white man they saw was a corporal of the Northwest Mounted police, who came in by dogsled on Jan. 2. Two months later a Hudson Bay company factor, trading agent to the Eskimos, paid a call by dogsled.

For the most part the job of flying 130,000 critical items to army posts on every continent is a routine one, but occasionally the pilots run into adventures unscheduled. One cargo plane flying 100 feet above the waves of the North Atlantic sighted a Nazi submarine plowing along the surface. Unarmed, the plane could do nothing but evade the U-boat's guns. Other pilots have crossed and recrossed the Atlantic many times at high altitude with only one or two glimpses of the ocean. Records for ocean crossings have become such a common-



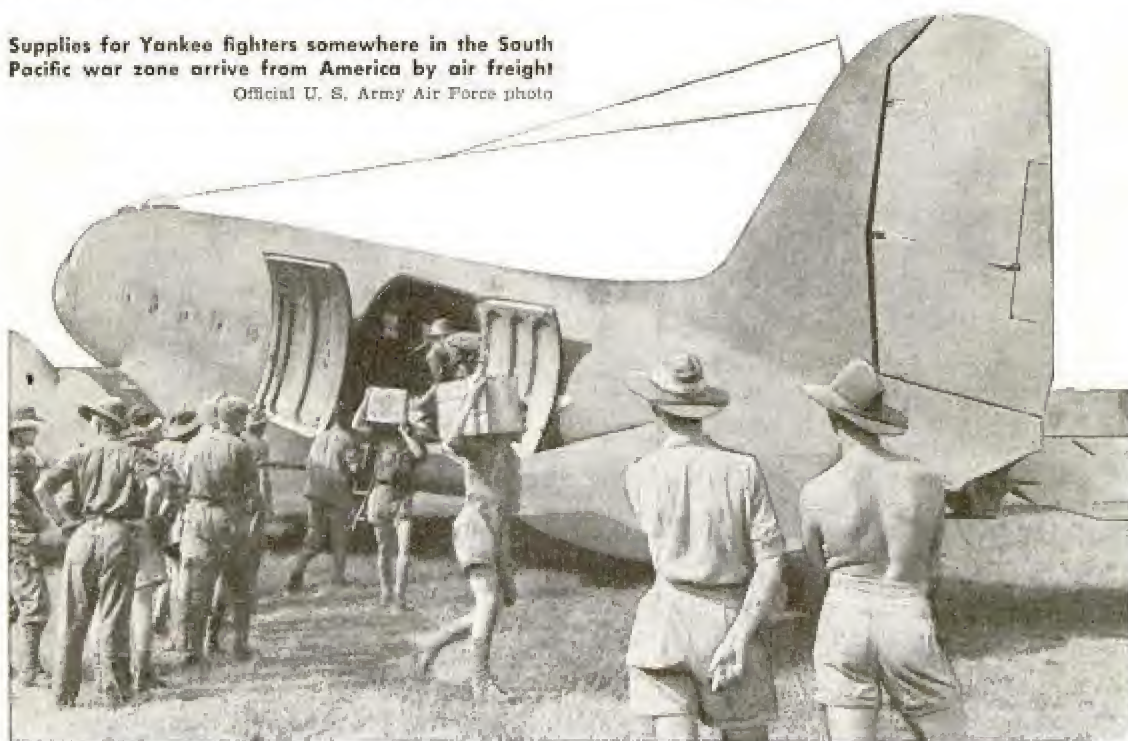
Stowing cargo in an ATC freighter. These giants of the world's largest air line carry more than a million pounds a week in this hemisphere alone

place that they cause no stir at ATC headquarters. The latest remembered was the 6 hours and 40 minutes crossing of the Atlantic by a Liberator bomber; another of that breed flew from America to Australia in a day and a half.

It was an Air Transport Command crew ferrying a Flying Fortress to England that deviated from its routine path to go to the aid of another crew that had crashed and stranded on the Greenland ice cap. It was

(Continued to page 156)

Supplies for Yankee fighters somewhere in the South Pacific war zone arrive from America by air freight
Official U. S. Army Air Force photo



Mobile Hoist Loads Half Ton Of Freight Into Plane



With portable hoist, two men can handle a 1,000-pound parcel

Minutes saved in loading or unloading a plane on the ground can be interpreted as added miles of flight, since it cuts down the aircraft's wasted time. With the aid of a hoist manufactured by the Elwell-Parker Electric Co., only two men are needed to raise or lower a half-ton of freight. The hoist picks up the bulky parcel and deposits it on the floor of the plane, or as readily removes it from the plane and lowers it gently to the landing strip.

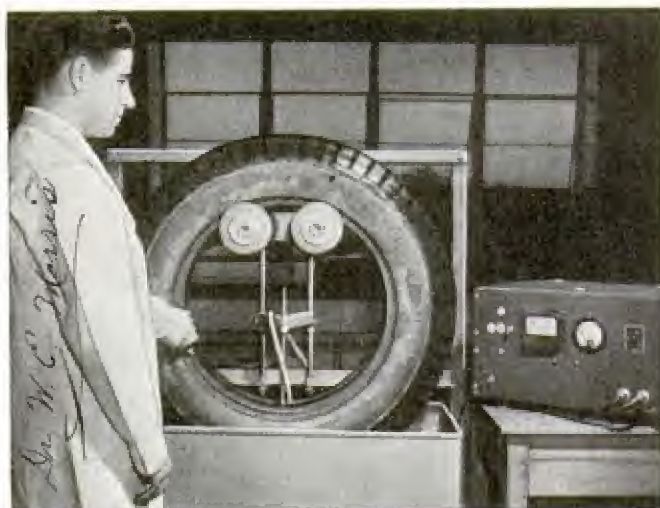
Glider Aloft Roars 'Shhh!' As Air Flows Over Wing

By no means does the sound of a plane's motor account for all the noise it makes as it hurtles through the air. Contrary to popular notion, the inside of a glider—which has no motor at all—is a very noisy place; so noisy that conversation at a speed of about 150 miles an hour is all but impossible. Air turbulence is the reason. Air flowing over the wings and about the fuselage produces "distressing, high-frequency, random noises which sound like a mighty Shhh!"

according to a report to the Federation of American Societies for Experimental Biology. In an airplane, part of the noise is due to the "thunderous" agitation of the air by the propeller, and the higher the horsepower of the motor the noisier that thunder, because as the tip speed of the propeller increases a large proportion of its driving energy is converted into sound.

"Supersound" Tests Tires By Finding Break in Plies

Waves of sound above the audible range, created by magnetostriction of a nickel rod, are used at the Goodyear Laboratory to detect separations at the vulcanizing point of two plies in a tire carcass. Such a rupture will not show under X-ray. If there is a separation, the tire is unsuited for retreading. Magnetostriction, actually microscopic shortening and lengthening of the rod, produces a sound wave that, though inaudible, penetrates the tire carcass and is picked up by a microphone on the other side. Activation of the microphone causes a green light to glow on the recording panel. Where there is a rupture, the wave will not penetrate the resulting air pocket; there is no signal to the microphone and instantly a red signal replaces the green one, indicating that the tire is defective and not suitable for retreading. The casing is hung on two rollers during the test, making it easy to inspect the entire circumference.



Red light flashes on showing a separation between two plies

Goodyear Tire & Rubber Co.
Akron, Ohio.
POPULAR MECHANICS

7557

7525

7548

Dr. W. C. Harsco

Ref: Sidney J. Wain, 247 Park Ave., N. Y. N. Y.
G. A. Squibb & Sons, 745 5th Ave., N. Y. N. Y.
7/6/43

Wonder Drug Made From Mold Aids Wounded



Penicillium notatum mold (left), similar to that found in bread, secretes the new lifesaving drug known as penicillin. It grows in glass culture bottles (below) and it takes about 500 quarts of fluid to make one ounce of microbe-killing powder

Photos courtesy E. R. Squibb & Sons

Penicillin, hailed as the miracle drug of 1943, is so potent that one part in 25 million parts of water will stop the growth of bacteria. This new microbe killer, which promises to surpass the phenomenal family of sulfa drugs, is made from a mold similar to that found in bread. It was discovered accidentally in 1929 by Dr. Alexander Fleming in the University of London laboratory. One morning he discovered that a secretion from mold had killed all the bacteria in a culture dish. The greenish-brown powder made from this secretion is today fighting infection on battlefields. Penicillium notatum mold grows on a liquid concoction of mineral salts and sugar. As it grows in glass culture bottles, the penicillin diffuses into the liquid beneath from which it is harvested by high vacuum evaporation. It takes about 500 quarts of culture fluid to make one ounce of the drug—one reason why all present production is allocated to the armed forces. Tests show it is superior to the sulfa drugs for infections produced by staphylococcus aureus. It is also



used to fight pneumonia, gonorrhea, osteomyelitis, and streptococcus infections. There are no unpleasant after effects for the patient. Penicillin acts faster than sulfa drugs and cures certain infections those drugs cannot touch. While the limited supply of this drug is already at work saving the lives of fighting men, efforts are being made to increase production on a vast scale.

Superfuel Gives U. S. Warplanes 50 Percent More Power

Triptane, a supergas that raises engine power half again over that of motors burning 100-octane gasoline, can now be produced in quantity. Known for seven years, the hydrocarbon was made in only limited amounts, and at costs ranging up to \$3,000 a gallon. By a new process developed by scientists of Universal Oil Products Company, the fuel can be made commercially

at an estimated selling price of less than \$1 a gallon. Antiknock qualities of pure triptane, called "the most powerful hydrocarbon known for use in internal combustion engines," are so great that no commercial engine has been built that can utilize its full power value. Added to aviation gasoline, it makes possible future engines of even greater power and efficiency.

NOVEMBER, 1943

310 S Michigan Ave.
Dr. Gustav Goff Chicago, 4, Illinois.

WHY *an* AIRPLANE FLIES



The simple experiments on these pages might be called the "A-B-C's" in the basic theory of flight. At first glance you wonder what a couple of balls suspended on strings, a blown-out egg shell, pieces of cardboard and an electric fan have to do with aeronautics. In their small way, these objects react to the flow of air in the same manner as a giant bomber weighing thousands of pounds with a heavy load of fuel and black busters. Where does the pressure come from that can lift this plane off the ground? Two centuries ago a famous Swiss physicist, Daniel Bernoulli, discovered that the pressure in a fluid decreases as the velocity of the fluid increases. The "Bernoulli effect" explains the curve of a spinning baseball. In aviation it explains the reduction of pressure on the wings that accounts for the greater part of an airplane's lift. The experiment with the two balls suspended on strings (above) shows how a region of low pressure is created. To your surprise, the balls come together when air is blown between them. The velocity of the air flowing between them causes a reduction in pressure, and normal pressure on the outer sides of the balls pushes them together. The reduction of pressure, or partial vacuum, is the lift that keeps an airplane aloft. When airflow becomes too slow, the plane stalls



With a blown-out egg shell and a small piece of cardboard mounted on opposite ends of a stiff wire, effect of streamlining is made clear. The wire is pivoted so it is free to turn when placed before fan. Tiny cardboard pulls away (below) showing greater air resistance

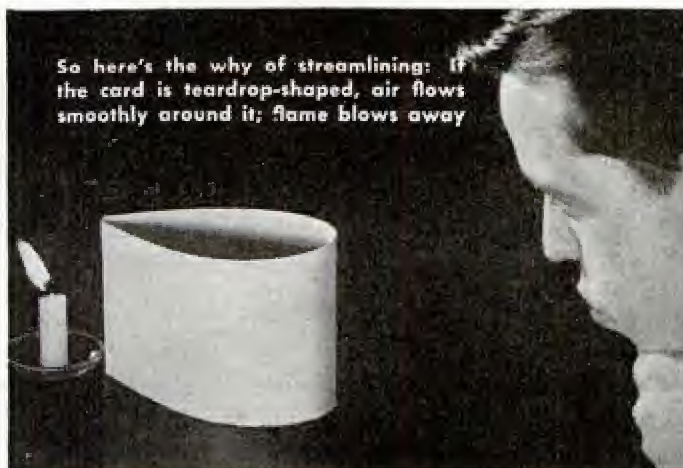


Blowing at candle here causes low-pressure pocket behind card—flame angles forward. Such pockets hinder flight

Three Levis, 551 Fifth Avenue
New York, New York.



Homemade wing section, made of thin paper on cardboard frames, demonstrates lift. Pencil is stabbed through wing section, permitting it to slide easily up and down. If book is held to cover upper edge of wing (above) and you blow against it, wing will lift slightly or not at all. If you hold the book to cover lower edge (left) and then blow, reduced air pressure on upper surface will cause wing to rise considerably. Below, strips of paper on end of tube are forced together by flow of air



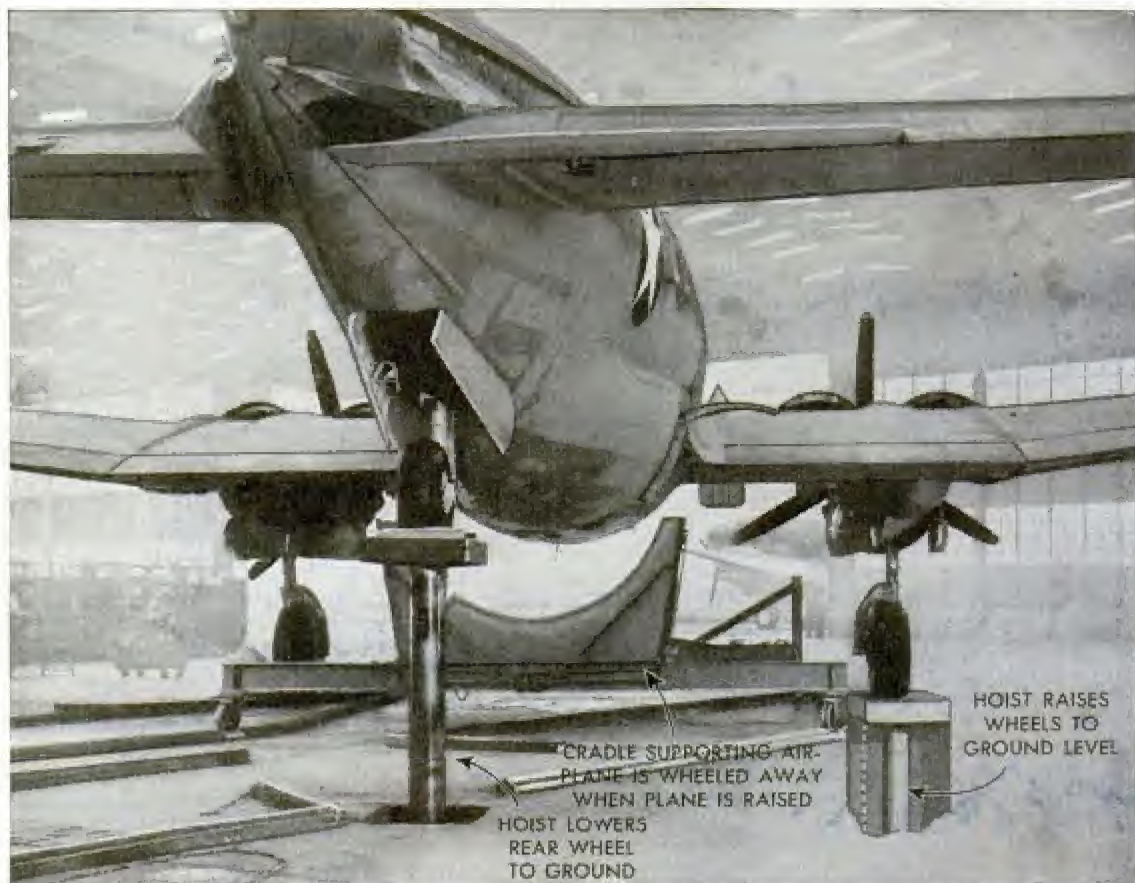
So here's the why of streamlining: If the card is teardrop-shaped, air flows smoothly around it; flame blows away



*Curtiss - Wright Corp.
Airplane Division
Buffalo, N. Y.*

77457

Wheel Hoists Lift Plane From Factory Cradle



Rolling to the end of the production line, a Curtiss Commando transport is removed from its production cradle as almost the last step before it rolls out of the hangar. To remove the huge plane from the cradle, on which it has rested during preceding stages of manufacture, three Globe hydraulic hoists are utilized, each of the three recessing into the floor. The plane is rolled

into position over the hoist pits, and the main landing wheels are locked in an extended position in the two front pits. The hoist at the rear is raised to support the tail wheel. Then the two front-wheel hoists are raised, and the production cradle is rolled on its track out of the way. Lastly, the rear hoist is lowered to floor level, and the plane rolls away on its own wheels.

Gauge Measures All Pipe Sizes From 1/8 Inch to 12 Inches



With a vest-pocket gauge you can measure all sizes of pipe from one-eighth to 12 inches in a few seconds. The measurement is made by three points of contact, two stationary and one on a movable section. A marker not only indicates the size of pipe, but the drill size for tapping. The gauge is handy for measuring pipe that is against a wall or in dark places where it can be carried to the light and read. Two edges of the gauge, which is made of steel with numerals etched in the metal, provide an inch and a metric rule.

Marker on movable section of pocket-sized gauge shows size of pipe. To take measurement, gauge contacts pipe at three points

POPULAR MECHANICS

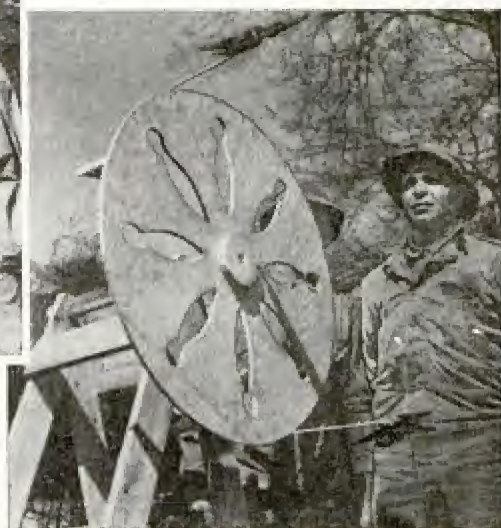
*Three Point Gauge Co.
3821 Broadway
Chicago, Ill.*

*L. B. Shawe, Major, 2 MC
Public Relations Officer
Quartermaster Replacement Training Center
Camp Lee, Va.* **71498**

Spotter's Wheel Gives All-Around View of Plane



"Spotter's wheel" below is whirled to give view of plane at various angles. Left, a bell rings when proper plane is identified



Men of the Quartermaster Corps who deliver the goods to soldiers in the front lines are constant targets of enemy planes, seeking to interfere with supply. To prepare the supply forces for antiaircraft firing, a thorough course in aircraft identification is given at the corps' replacement training center. One device to help the soldiers identify aircraft, whatever their angle of approach, is a wheel, revolved by a crank, to which are attached model planes. Revolutions of the wheel make the models spin in a constant loop, presenting views of the plane at virtually all angles. Another recognition device is an electric

board, studded with models of various planes. On the bottom of the board is a row of buzzer buttons, each tagged with the name of a plane. A trainee is asked to identify, say, a "Flying Fortress," then presses the button above the model that he believes to be that craft. If his choice is correct, a bell rings. If not, no connection is made, and he must try again.

Radio Trailer's Test Beam Locates Landing Transmitter *71510*

Steel buildings, railways and numerous other structures may cause severe reflections of radio waves. Accordingly, transmitters intended to guide airplanes to safe instrument landings must be located where such interference and distortion will not occur. Each location for such a transmitter requires research, to produce a straight localizer path. In the words of Civil Aeronautics Administration officials, it is a question of "cut and try" in setting up every location. Equipment to test the efficiency of such radio waves is mounted in a trailer, to simplify the testing of various sites for the transmitter, and speed the choice of the site of the permanent installation.

To assure freedom from interference at site of airport landing beam, portable transmitter is used to test locations



77169

CHEATING DEATH *at SEA*



U. S. Navy photos

Seamen on this torpedoed tanker put out flames and made port. Left, salty firemen wear asbestos suits



ONE of the most fascinating developments of the war has been the manner in which man, a creature of the land, has learned to cheat death in the world's seas.

Every man who ventures forth on, above or beneath the waves of the world's oceans today is a hunted creature. This is primarily a war of transportation and the aim of the Axis is to throttle global movement of men, weapons and supplies. The aim of the United Nations is to free the seas. The struggle never ceases, day or night, in this liquid jungle.

Just as hunted animals of the forest exhibit cunning which fits the special dangers of their environment, so inventive man is developing courses of action, tricks and machines to bring the men back alive, even though the ships and planes sink to the bottom forever.

Hundreds of men died in the early months of war before the familiar cork life preserver was improved or discarded, after it was discovered that it often jerked up as a man leaped into the sea, hitting him

on the chin with a knockout blow. In times of peace a man could make a comparatively leisurely exit into a lifeboat; in time of torpedoes and bombs, he often had to jump. He sometimes leaped into the arms of death. Hundreds more were killed by this type of preserver because it slipped above the head as it struck the water, serving only to keep the face under until the wearer was drowned. An extra piece of cord to keep it down would have helped, but no one seems to have thought of this at first.

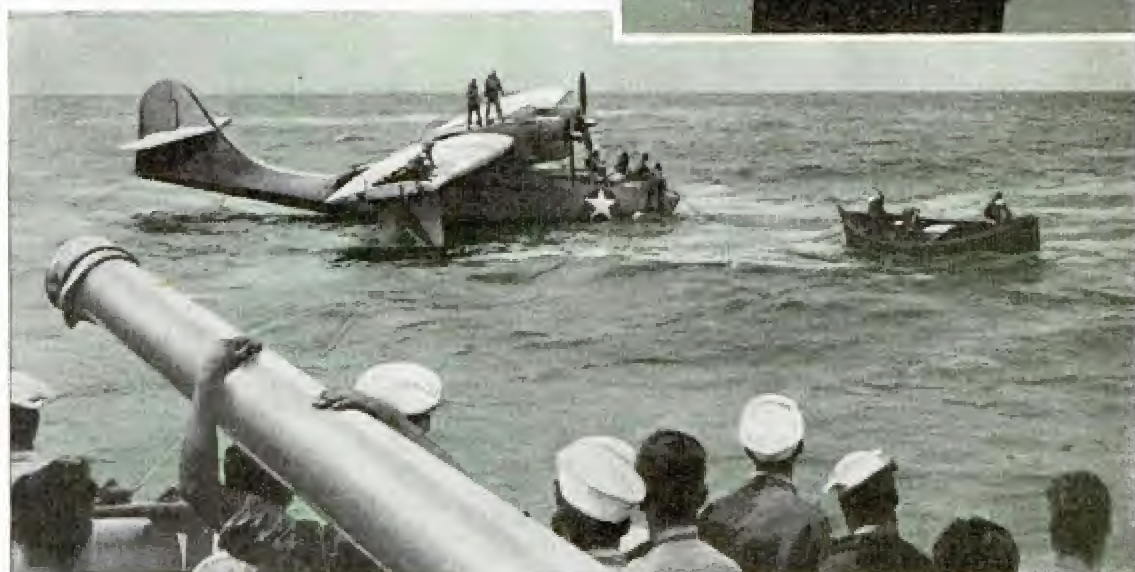
Now there are dozens of types of efficient life belts and jackets. One light rubber, inflatable belt can be worn around the abdomen with such ease that it does not interfere with shipboard duties. Yet, squeezing a couple of cartridges of carbon dioxide fills the belt with buoyant gas and snugs it tightly below the armpits. Life belts operating in the same way are so comfortable they serve as an added piece of warm clothing. Rubber tubes permit the belts and



Alert Navy gun crew on a merchant ship snaps into action during a practice alarm. They cheat death by scaring off subs or planes

Right, rescue buoy can be worn like a pair of pants, or, with ropes attached serves as a breeches buoy. Seamen vouch for its safety

Below, rescuing men on patrol bomber forced down at sea by engine trouble. The plane was towed in for repairs by a helpful destroyer





U. S. Maritime Commission photo

Rigged with sail and spray sheet, the new lifeboats on Liberty ships are designed for safety and comfort

vest to be inflated by mouth if necessary. Feathery kapok-filled life vests can be worn day and night aboard ship without discomfort.

One type of "overall" life saving suit, now standard equipment on U. S. merchantmen, covers all of the body but the face and when in use, keeps the wearer bobbing head up in the water, dry, cozy and comparatively warm for days if necessary. Weighing only 14 pounds, it contains a built-in flashlight and whistle. The hood and palms of the gloves are a brilliant yellow to attract attention.

The suit may be worn over regular clothing and a life jacket besides. It is donned by first putting the legs into boots with weighted shoes which

keep the body vertical, putting the arms in sleeves with gloves attached, pulling a hood over the head and then yanking up a special watertight slide fastener which makes



Swinging through the air on transfer device for injured



the whole garment waterproof.

The tanker affords a startling example of the changes that the war has effected. In times of peace, this lumbering, cigar-shaped vessel was a safe type to sail upon. Crewmen, veterans and landlubbers alike, were unprepared for what torpedo, bomb and shell brought—a burning sea of gasoline with flames reaching 75 feet in the air, or a sluggish patch of heavy oil.

At first, many panicky seamen leaped into the blazing gasoline, only to be burned to death. Later, they were taught that tanker fires looked more formidable than they really were and that tackling them with fire hoses pouring out chemical extinguishing agents usually snuffed out the flames. Or clouds of "snow" from carbon dioxide cylinders were enough to quench the worst blazes. They also learned that because of their bulkhead and compartment construction and lighter-than-water cargoes, tankers are hard to sink and a man has plenty of time to wait before plunging into a sea of fire.

They also learned that it is just as easy to wait until wind or sea has cleared away a blazing area of gasoline or a gummy patch of oil, or to put off from the windward side of the vessel and to avoid use of rafts when possible because they cannot be maneuvered in either burning gasoline or sludgy oil. They became aware that a lifeboat is hard to work out of a heavy patch of oil and must usually be guided by oars instead of rudder. And that a man in a life jacket might as well paddle through swamp muck as through a slick of clinging oil.

So men live and learn—live because they learn.

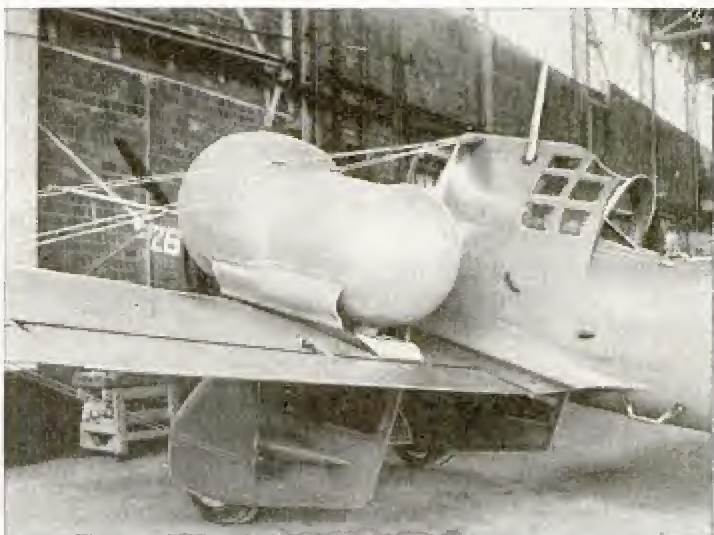
In times of peace, the death of a gallant merchantman was

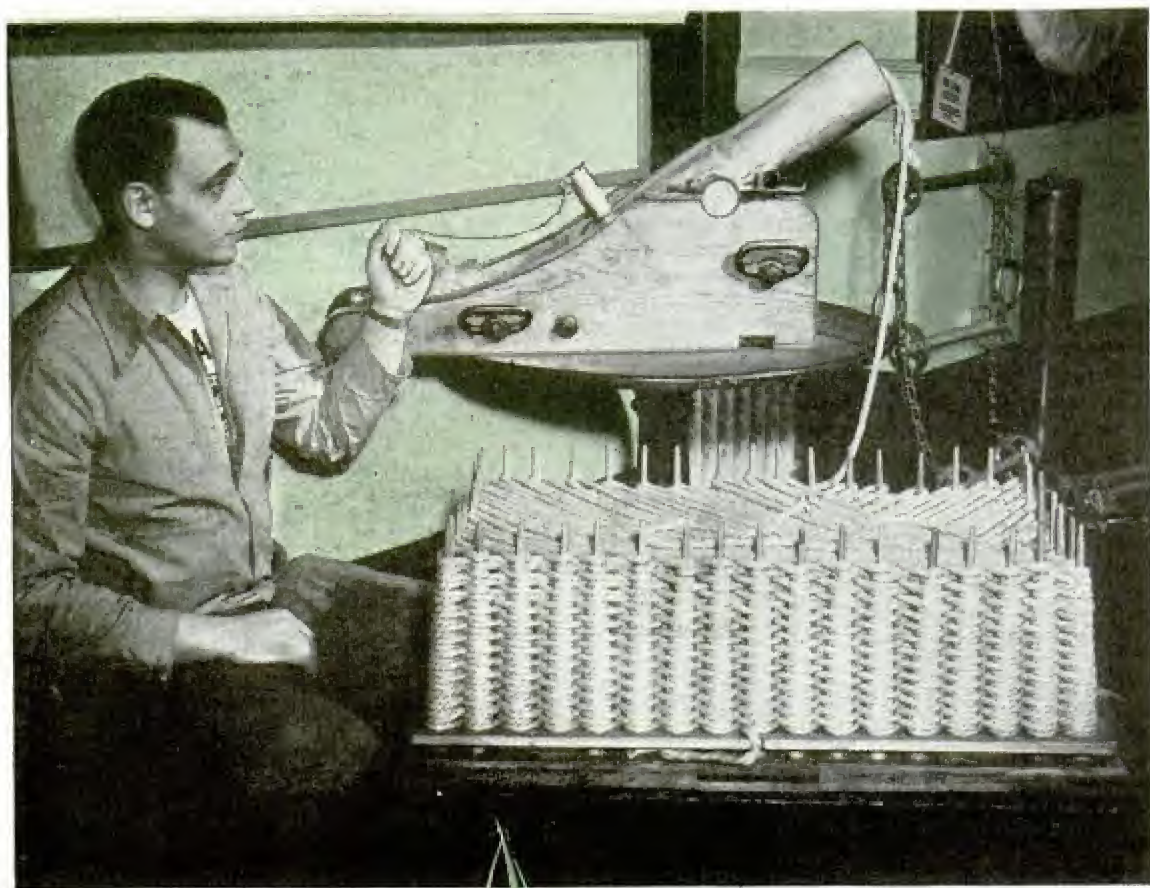


Sailors on convoy duty protect their faces from icy blasts with this Arctic weather mask. Opening for the mouth has snap-on flap



"Doughnut" life raft can sustain 15 men inside mesh on platform and hanging on outside ropes. Below, emergency flotation gear on wing of land plane will keep it afloat if it's forced down at sea





An oddity to landlubbers is line-throwing gun for rescue work. Note the line holder

Below, inspecting model of an unsinkable lifeboat which has special compartments

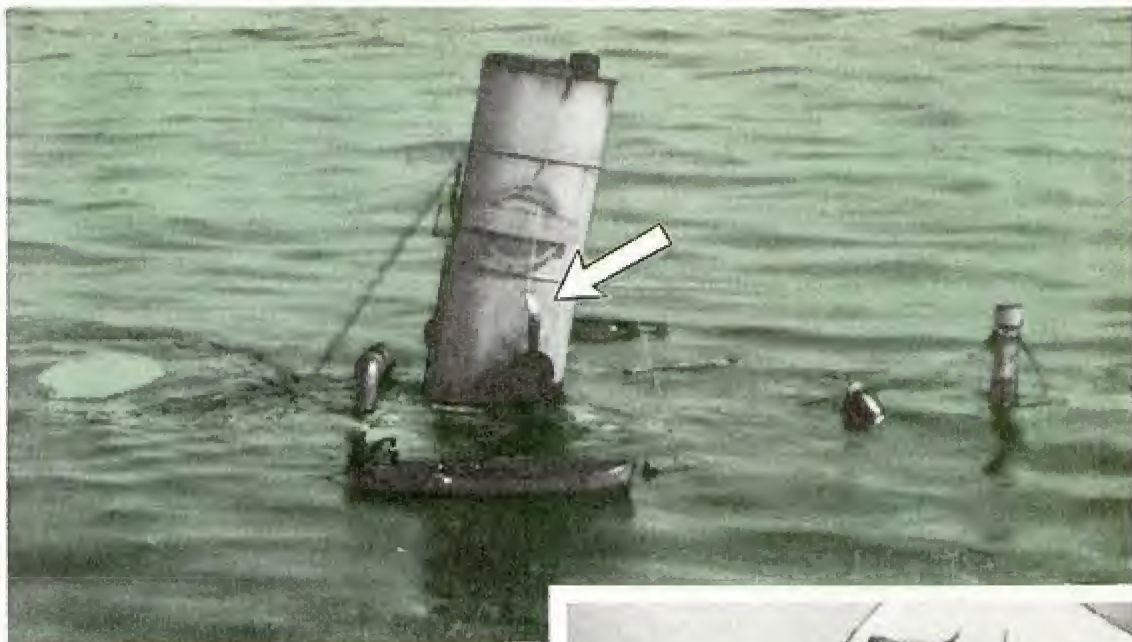
usually a slow process with plenty of time for a safe getaway. The crash of a bomb or the blast of a torpedo changed this.

Instead of a graceful dive after hours of preliminary settling on even keel, the merchantman often blows out her decks, splits in two or keels over. Seconds count where hours were available before ships were blasted to their doom. Hundreds of lifeboats and rafts went down with the vessels because the quick list made it impossible to launch them. Either they were dipped into the water on the downside or they were hung on the side of the hull on the upper side. Often weighing tons, they could not be maneuvered by hand. Also, during the early panicky days, the crew would attempt to put down boats while the ship was still making good headway. The boats



*Charles Farrington
432 W. 22nd St.
N.Y.C.*





Sailor (see arrow) gets ready to jump from perch on doomed ship. Right, Very pistol and cartridge

often swamped. Dropping the forward end first into a wave swamped many more.

Improved davits, better trained sailors, and mechanically improved skidding devices for launching rafts have made the getaway from decks easier and quicker.

Another lesson was learned on vessels which carried depth charges. The charges are usually pre-set for explosion at certain depths and in the excitement following a torpedoing, the crew forgot to neutralize the firing devices. Depth charges went down with the ship, exploded as scheduled and hundreds more lost their



lives. After such a tragedy, dozens of men were picked up dead without a visible sign of injury. Concussion carried through the water had ruptured organs such as the heart or kidneys.

It was commonplace with the sailors of many nations in the early days of the war to tumble into a lifeboat only to find the oars had been lost in lowering, or that the water

Waterproof telephone in station of bow lookout on Liberty ship



Morse code signaling lamp has key which causes it to blink. Below, wounded marine is lowered carefully into a tank lighter



tanks were empty, dooming them to thirst, or that the food was moldy or saturated by sea water. Or that no knife or hatchet was available to cut them loose from the davits or to free the tiny bobbing craft from tangled ropes. Or the fittings were rusted away, causing masts to fall.

These days are gone and the lifeboats are regularly inspected, fully equipped, many with motors, and fully provisioned. Just about everything a man can want when shipwrecked is firmly attached to rafts, too, including signaling devices galore.

An early mistake which has been corrected had to do with the lack of ladders and ropes which enabled men to escape from the lower regions of a vessel or from the decks if they reached them. Every engineroom of a modern ship usually has several exits aside from the main corridors and their stairways or ladders. At the beginning of the war, men were not trained where

to look for them. The addition of rope ladders leading to emergency engineroom exits, in case a broken steam connection shuts off ordinary passages, has saved hundreds. And the use of patented metal ladders and easily handled rope cargo nets has enabled thousands to climb down the slanting sides of a dying ship.

Warwise sailors who formerly made frantic and often fatal haste to get away from the sinking vessel to avoid being sucked into the depths of the sea as it dived, have learned that when a ship goes down bow first or stern first, it slides under the waves and very little suction is created. Only when a ship goes down quickly on a horizontal plane is there much danger from suction.

The code of lifeboat conduct has been pretty well established. Some of its rules are to drink no sea water because it contains about a teaspoonful of salt to each cupful and only increases thirst. Avoid eating



Crew of torpedoed tanker battles flaming oil with chemical fire extinguisher—standard tanker equipment

if no water is available. Be sparing with food containing sugar or salt. Regardless of the weather, do not discard clothing because the tropic sun can be as torturing as the Arctic wind is cold. Stop exertion as far as possible. Avoid alcohol as it increases thirst. Do not depend on fishing

lines too much because the little fish which are attracted by boats and rafts only attract bigger fish and if you hook a little one, a big one will usually snap up the little one and perhaps your hook along with it. Lacking tackle, try spearing small fish with a knife or catching them with the hands.

In this war, the ships that sail the air above the sea are far more numerous than the ships which plow the waves. Starting with fresh viewpoints, the designers of lifesaving apparatus for airplanes developed some tricky devices, most of which are based on the fact that rubber containers take up little space, but hold a lot of air, and air will float.

The doughnut-like rubber boat or raft is remarkable in efficiency and scores of men have lived weeks with little food or water with nothing.

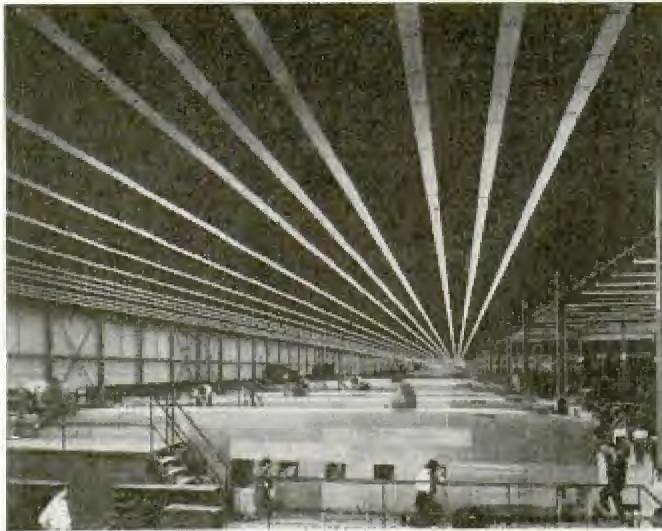
(Continued to page 152)



One-man parachute boat has paddles for downed aviator

*Shill & Knowlton, Guildhall Bldg. Cleveland, Ohio.
for The Goetz Co., Architect-Engineer-Manager, Okla. City, Okla.
77 517*

"Breathing Wall" Has Flue to Combat Moisture



Above the fuselages of C-47 cargo planes (left) fluorescent lighting gives fanlike effect in windowless building. Below, cross-section of wall in aircraft plant shows inner flue arrangement with open joints at bottom and top for "breathing" to keep moisture out of insulation



Believed to be one of the largest masonry structures in the world, the new Oklahoma City Aircraft Assembly Plant has nearly two miles of windowless "breathing" walls. Inside the brick wall is a flue of ventilating tile that permits a passage of air through openings near the top and bottom. The tile has a perforated back which allows a four-inch blanket of rock wool to "breathe," thus keeping it dry and providing insulation equal to that of an 80-inch brick wall. The only steel in the wall is in the lightweight ties that hold the many layers of the structure together and also serve to hold the insulating wool

in place. Another steel saving—170 tons—was effected by the use of Masonite instead of porcelain enamel in reflectors for more than 20 miles of fluorescent lighting fixtures. These reflectors have a synthetic enamel surface. A white cement floor insures light reflection on the underside of the wings and fuselages of the big Douglas C-47 cargo planes built in the plant.

Collapsible Plane Wheel Chock Permits Faster Takeoffs

Light, collapsible metal chocks make possible swifter takeoffs at several army airfields because the plane's tire merely runs

over the chock after it has been released. Designed by Earl C. Gregg, civilian mechanic at an Oklahoma flying school, the

chock consists of hollow steel tubing, a small amount of solid steel shafting, and a boiler plate apron. The apron and retaining framework bear the weight of the plane during the warmup period, preventing the wheel from sliding forward or backward. The chock can be collapsed by pulling free a solid steel loop handle at the rear of the chock, allowing the weight of the plane to force the structure flat.



Above, chock is collapsed when plane is ready for takeoff. At right, it is shown set up to prevent sliding of wheel



*29th Sub-Squad aircraft maintenance
26 group at Army Air Corps Flying School, Okla.*

"Tank Treads" Let Plane Land on Soft Ground N 559

Landings on soft or sandy ground, or even on excessively rough fields, are possible with a caterpillar-type landing gear, resembling the endless tread of a tank. In spite of its size, the tread uses about the same amount of rubber that would go into an airplane tire, but gives



Caterpillar-type landing gear permits ship to land on unfavorable terrain at speeds as high as 120 miles per hour

the plane from four to eight times greater contact area on the ground. Landings on unfavorable terrain can be made at speeds as high as 120 miles an hour in planes equipped with the gear. It is constructed

with steel bracing and grooved aluminum bogie rollers. The rubber track has a wire beading on the edges grooved to fit into the roller grooves, to prevent side slippage. Firestone Tire & Rubber Co., in co-operation with the Dowty Equipment Co. and the U. S. Army Aircraft Laboratory at Wright Field designed the structure.

Largest Mobile Gun in World Is U. S. 240-mm. Howitzer N 567

Shooting a 350-pound projectile whose effect is said to be more potent than that

of any aerial bomb, the Army's 240-millimeter howitzer is the largest mobile gun in the world. Its primary use is to batter down fortifications. It has a range of slightly over 14 miles, and with the fire-control apparatus in good work-order, experts say, under average atmospheric conditions its projectile will not miss the mark by more than three feet. In spite of its huge size—240 millimeters is equivalent to about nine and one-half inches, and the barrel is some 27 feet long—the big howitzer is capable of astonishing mobility behind the Army "prime movers" that haul it.



This gun can hit within three feet of its target 14 miles away. The barrel is about 27 feet long

Mr. Thomas C. Stinson, Jr.
3872 Franklin Avenue
Los Angeles, Calif.

N 360

SAGA of the REDWOODS



California Redwood Ass'n

IN THESE days of metal shortages, imagine how valuable a lumber would be that was fire-resistant, didn't rot or swell, and that was practically insectproof. Lumber like that could be used in place of metal for water tanks, flumes, chemical storage vats, and for a host of other things.

America has such a wood, and is using it for just those purposes. In fact, we have

Above, cutting up a huge redwood downed for commercial lumber. Left, a fallen redwood at least 1,000 years old now overgrown by another tremendous tree

a world monopoly in this uncommon timber. California redwood is not only a strategic material but is unique because its trees are the oldest and largest living things in nature.

A large redwood may measure more than 20 feet in base diameter and tower to a height of more than 300 feet. The tree may have been a sturdy sapling at the beginning of the Christian era. Its trunk may weigh some 500 tons and contain more than 100,000 board feet, enough to build an estimated 20 or more homes. Its bark sometimes grows two feet thick.

Redwoods grow in a coastal belt from south of San Francisco on up into southern Oregon. Their impressive grandeur makes a trip along the Redwood Highway unlike any other in the world. You drive, on a modern highway, through primeval forests of redwoods that are so tall that from the car window you see only the bases of nearby trees. You must stop and get out to look



Redwood Empire Association photos

From the bark of such trees as the monarch above come fibers now mixed with wool to make blankets and felt hats (right)

at their tops. Ferns, mosses and needles carpet the ground between the trees.

You appreciate the age of the giants when you inspect a section of trunk that has been placed on display. Sawed straight across so that its annual rings are easy to see, the cross section reaches way over the spectator's head. The redwood may have been 1,400, 1,700, or 2,000 years old when it fell. It was a mature tree at the time of the First Crusade.

The impressive thing to the observer is that he can span with his hands, reaching in from the bark, the dates of the annual rings with which he is most familiar. Beyond his hands the wood still reaches foot after foot toward the heart. Practically at the outer edge is the ring that marks the start of the first World War. An inch away are the rings that grew during the Civil War, another few inches is the 1776 ring, and within reach of his hand is 1492. The second word of the coast redwood's botanical name, *sequoia sempervirens*, means "forever green."

From the growth rings, too, can be traced the life history of the tree itself. Study of a 1,200-year old trunk at one grove shows that the tree was





Tallest and oldest living things are these redwood giants. In the 1,500,000 acres of the Redwood Empire in northern California and southern Oregon are 97 percent of the world's redwoods



scarred by fire in 1147, that it was attacked by fire also in 1595 and that new growth, coming together from each side of the wound, imprisoned some bark at that point. A series of fires all on one side attacked the tree in 1789, 1806, and 1820, leaving it in an unbalanced condition. Immediately the tree began to throw out a strong supporting buttress on the weak side, building itself out for 36 inches during the next 100 years. But the buttress didn't grow fast enough to provide the

support needed and in 1933, when the ground had been softened by heavy rains, the tree fell.

The Russians were the first white people to utilize the redwood. Russians who colonized in an area north of San Francisco more than a century ago built numerous buildings from redwood saplings. Mature trees were too big to be cut or worked with the tools they had. Their wooden church still stands today, in excellent condition.

In the gold rush days when redwood lumbering began in earnest, a crew of Paul Bunyans was needed to fell one of the giants. The base of a tree was usually too thick to attack, so the lumberjacks cut holes through the bark 12 or 14 feet above the ground, placed springboards in the holes to stand upon, and sawed through the tree above that point. Even so, a redwood saw with a husky man at each end might be 20 feet or more long. When a tree had been felled, trimmed, and cut into sections, these sections were still too big to handle, so they were split open with dynamite. Ten or 12 yokes of oxen then hauled a chunk of the wood to a mill.

Modern lumbering methods have changed all this. The trees are still felled by hand although motor-driven saws are also used. A tree is dropped onto a bed of bark and branches to ease its fall,

Left, building a protective roof of redwood over a water reservoir. Below, great logs are handled with ease at a sawmill



the bark is trimmed from it, and the trunk is cut into sections that can be handled efficiently. A tractor with a special trailer hooks onto a section and drags it down to camp, where it is loaded onto a truck or narrow-gauge railway for the trip to the mill. Of course, not every redwood tree is of giant size. Most of those cut commercially range from 8 to 10 feet in diameter.

Redwood is a soft, close-grained, dark red wood. Few woods possess its resistance to fire, decay, or insect attack. It is these features, of course, that allow it to attain great age. It has a very low shrinkage factor with little tendency to warp. It resists chemical attack. These characteristics have led to its wide use in the United States and in many other parts of the world as bridge timbering, water storage tanks, cooling towers, aqueducts, for fermenting and storage vats in a number of chemical industries, and for the storage of wines, cider, cheese, and petroleum products, among others. It is wide-



Above, felling a big tree with an electric saw powered by a generator on a Caterpillar Diesel tractor. The logging train below is hauling new-felled timber to a sawmill in the Redwood Empire



Snaking around the mountain at left is a continuous-stave redwood pipe built to carry irrigation water



ly used in areas where other woods are rapidly destroyed by termites. It withstands the effects of weathering. In fact, the best example of the durability of the wood is to be seen in one redwood grove where a giant tree has grown around and over a fallen trunk. The fallen trunk has been imprisoned for 10 centuries or more, yet its wood is still strong.

Redwood lumber has been widely used in residential construction, outside for its durability and inside because of its decorative value. Burls, or close-grained knots of redwood, take a high polish and are made into ornamental trays and other pieces. Redwood bark has a high insulating value. Shredded and ground up into a wool, it protects homes against summer heat and winter cold, and is also used for insulating locker refrigeration plants. The bark is fire- and vermin-resistant.

The fibrous bark is also woven into



Redwood Empire Association photo

Here is the famous "Tree House," built within a giant of redwood forest

cloth. Redwood cloth consists of up to 60 percent bark fiber with a corresponding amount of wool. It is made into suitings, blankets, and felts, and produces a warm, fluffy cloth that is worked and dyed easily.

Vast areas formerly occupied by redwood forests have been logged off and one estimate is that one and a half million acres of the trees remain. Preservation of large tracts of the giant trees in their original wilderness settings is the purpose of the Save-The-Redwoods League which has joined with the state in acquiring and deeding to the public some of the best and most accessible groves. Lumbermen are in sympathy with the movement and are practicing a selective logging program and

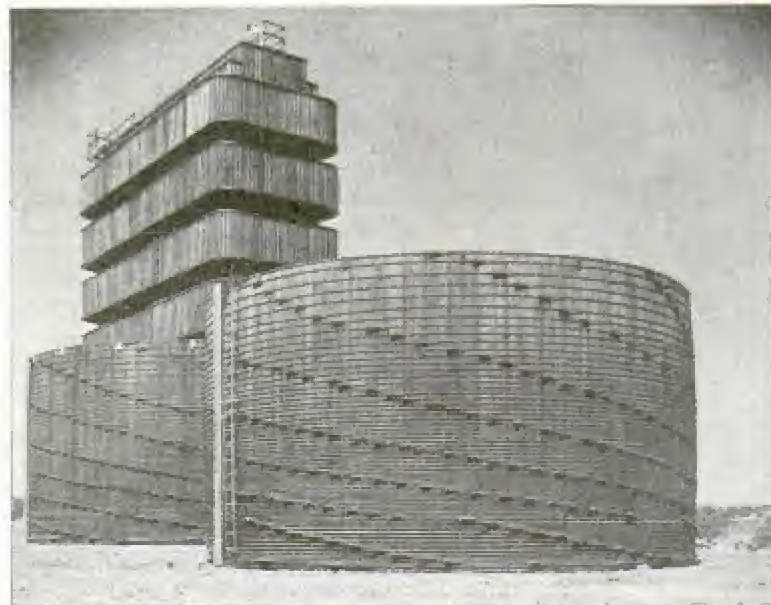
at the same time are carrying on re-seeding and re-planting with the expectation of putting redwood lumbering on a self-sustained basis. This is not as far-fetched as it seems in view of the ages of the large trees, because redwoods attain much of their growth during their youth.

Redwoods were large flourishing trees identical with those of today during the age of the dinosaurs. Fossils show that 50 million years ago the redwoods were widely spread over the northern hemisphere. Only in California did the trees escape extinction during the last glacial period.

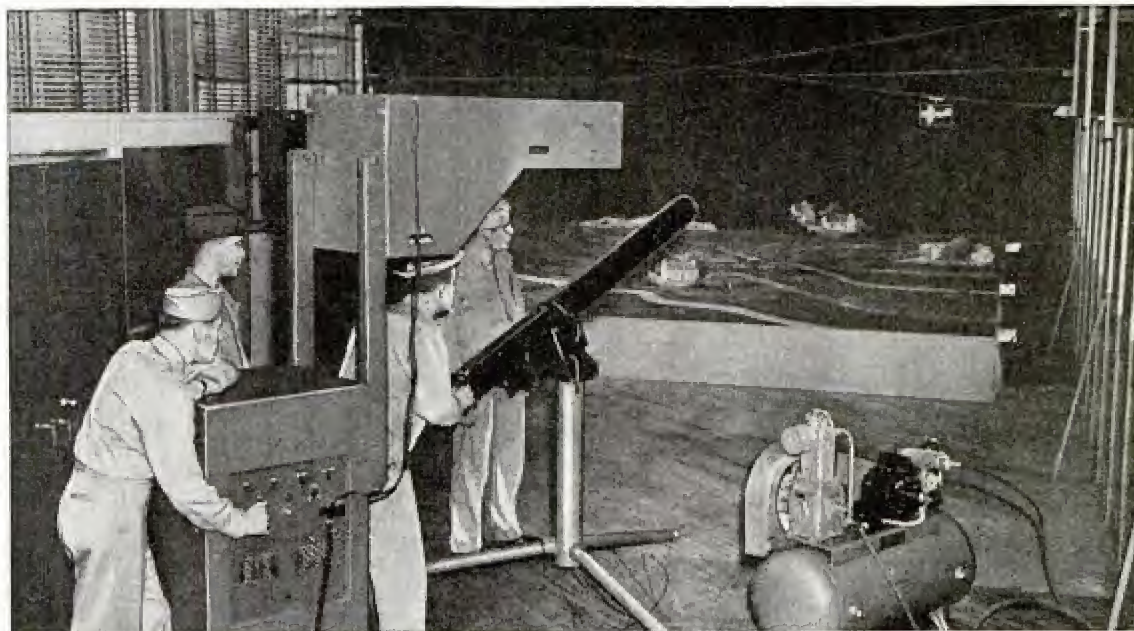
Large as it is, for brute size alone the coast redwood doesn't compare with its relative, sequoia gigantea, that is found in a 50-square-mile area east of Fresno in the mountains of central California. The sempervirens rarely exceed 20 feet in diameter as compared to gigantea that approach 40 feet in base diameter. The largest officially measured redwood, the General Grant Tree in General Grant National Park, is 40.3 feet in diameter at the base and is 267 feet tall. It is situated in a mixed forest in which sugar pines with base diameters of 11 feet and ponderosa pines, silver firs, and cedars almost as large occur. There are stories that an even larger "big tree" than the General Grant is located somewhere in the mountains in the same area.

The redwoods have been called a living link with the past, which they truly are. Public and private agencies that are continuing their work to preserve more of the forests are doing so in order that future generations may also enjoy them. Barring an abrupt change of climate or some unpredictable catastrophe, the California redwood groves should still be flourishing thousands of years from now.

Cooling tower and tanks built of redwood which does not swell and so remains watertight even if alternately wet and dried
Black, Sivalls & Bryson, Inc.



Training Machine Gun Fires Pellets of Plastic



Raking target with realistic "bullets," this training weapon performs like a regular Browning machine gun

Operated by compressed air and electricity, a training machine gun simulates the action of a Browning weapon. It fires 600 times a minute, but uses only 100 plas-

tic pellets so they are in the same ratio as tracer bullets. Pellet velocity and trajectory are according to scale, and recoil and noise are much like that of a real gun.

Chicago war plant

Rope Harness, Sawdust Pool, Used in Dry-Land Diving

"Dry-land diving" is what Coach Fred Lanoue of Georgia Tech calls his technique for teaching proper form off the springboard, without benefit of any water. The student diver is sustained by ropes, operated by the instructor, who can let the

diver down easily into the sawdust pit that passes for the pool. The diver wears a tumbling belt, padded with old football hip pads, according to Coach Lanoue's description in the Southern Coach and Athlete. To an overhead beam in front of the spring-

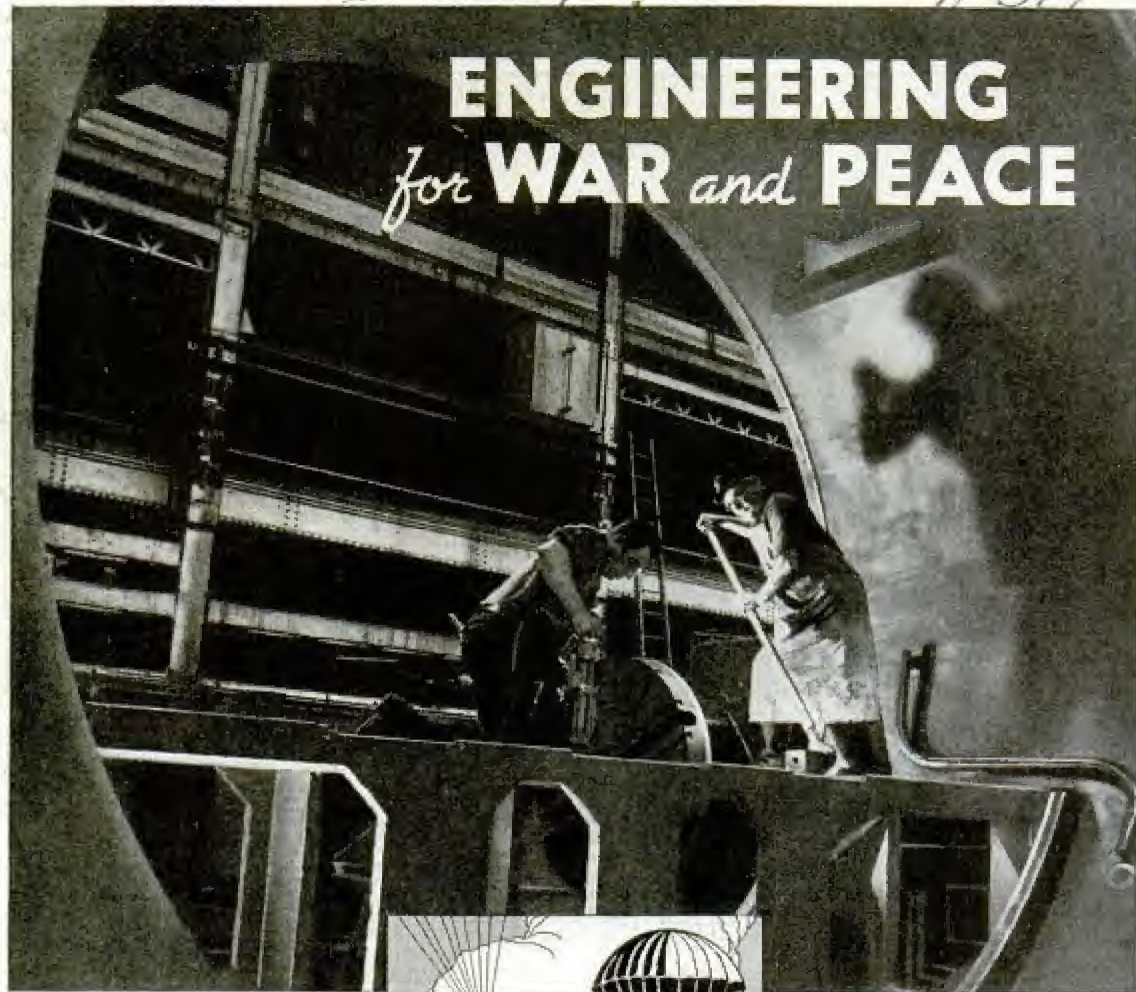
board are attached a single and a double pulley, with one rope running through both pulleys and one rope through only one. The ropes are spliced where they come through the double pulley, and the instructor thus has only one rope to manipulate. Snap clips attach the rope ends to the tumbling belt. Because the instructor stands always ready to let the diver down easily, student divers readily acquire confidence.



Soaring off springboard, student diver practices his form over a sawdust "pool," safely held in a rope harness by instructor

Coach Fred Lanoue Georgia Tech

ENGINEERING for WAR and PEACE



UP THE mountain roads of Sicily the American M-4 tanks rolled, their 75's blasting at the German positions ahead. No stopping to sight and fire. The big guns talked as they ran.

No enemy tank could do that. The enemy must stop and reaim, else they would waste shells at random.

A peacetime search for means of stabilizing American railway and industrial vehicles gave Yankee tank gunners this vital advantage over the foe. Westinghouse engineers had been seeking to control side-sway, vibration and jackrabbit performance of cars on road and rail. When war changed their goal, they turned up with an electric control by which the gunner can train his 75 quickly, with little effort, and fire five times as accurately. Gen. L. H. Campbell, Jr., Chief of Ordnance, says "We can fire this 75-mm. gun when the tank is in motion, which is more than any enemy tank can do. And we hit the target."



Power for war industry—above, building a 60,000 kilovolt-ampere condenser. Center, bicycle tail-lights get a war job lighting cargo parachutes after dark

That is one instance where peacetime research, turned to wartime use, has delivered victory. It works both ways. Wartime engineering is developing new techniques and products that will change our mode of living after the war. The gun control will smooth your railway trip,

but, more important, effect great savings of maintenance on track and train. It will be applied to velocity, acceleration and position controls of ships and cranes, elevators and steel mills.

War necessity has accelerated the development of electronic devices, power systems and engines. Westinghouse engineers who cannot talk of the present, which is wrapped in military secrecy, can tell something of the future. They predict that current improvements in electric locomotives

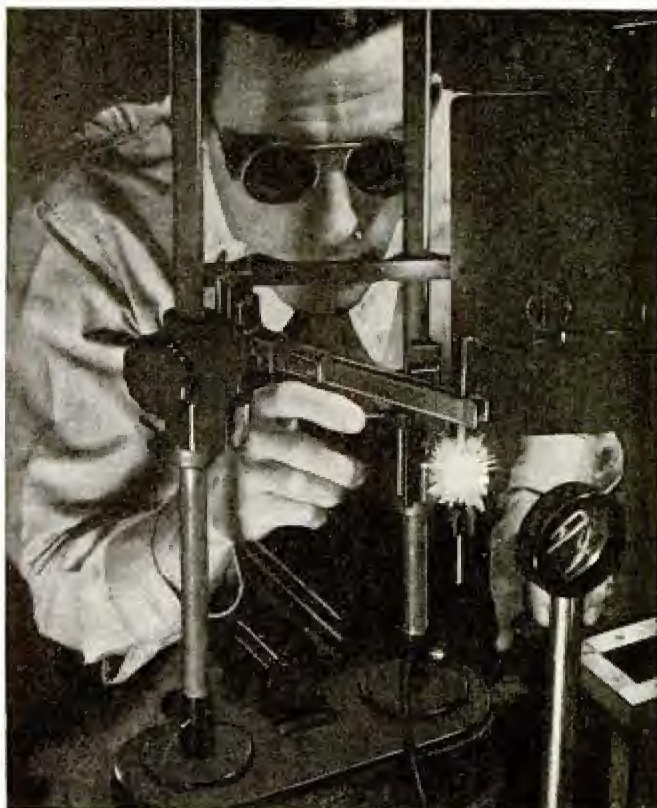
and power systems will bring an expansion of electric railways in heavy traffic centers after the war. They look for turbine-driven locomotives, perhaps with turbines geared direct to drivers. Such locomotives have already been designed and are ready for manufacture. A turbine locomotive of 6,500 horsepower would save more than 30 percent in pounds of steam per horsepower hour over the conventional steam locomotive. Besides economy in power, there would be smaller wheel diameters, no reciprocating parts, consequently less wear on engine and track.

Gas turbines are a possible motive power for the airplane of the future, too, and electric drive between turbines and propellers may revolutionize aircraft design.



The impact of the war probably has been greatest in the aeronautical field, and is manifest in the bewildering array of instruments that face the pilot of the 400-mile-an-hour fighter plane and the ocean-hopping bomber. Westinghouse research men believe it will be possible to relieve the pilot of much work by developing automatic engine controls that will take over such operations as carburetor adjustment, ignition advance and speed synchronization without attention from the pilot.

Not only did war take over the tools of peacetime industry, it took over the brains. Engineers who had thought in terms of kitchen equipment turned to wing-flap assemblies. Men engaged in electric motor research switched to



Top, electric current arcs sample of pure iron and spectrograph focuses radiation through prisms to record wavelength portrait of iron. Pilot's oxygen need is discerned (left) by watching blood color with phototube device. Below, welders work on turbo-generator, circled by frame for a huge motor





Heat guns firing explosive rivets used in aircraft manufacture incorporate the heater element from your electric stove, the thermostat from an ironer

problems of motorized tank turrets and antiaircraft range finders. The antiaircraft gunner has only two or three seconds to make the complex computations involved in knocking down a Messerschmitt or Zero. Among the factors are distance to target, its speed and direction in three dimensions, wind, force of gravity, elapsed time between sighting and firing. No human brain could add up those factors in time to meet a six-miles-a-minute plane with a shell. Engineers have built mechanical brains to compute the range automatically, instantly and accurately.

A metal disk the size of a half dollar used to control the temperature of electric irons so that your white shirt wouldn't be charred. Now the iron is a memory, but its little thermostat is very much in business. It is a watchman guarding against fire on planes and battleships. Attached to motors and strategic parts of warplanes, the thermostats operate like automatic sprinklers in factories. Fire causes the bimetallic disk to move and close an electric circuit flashing a light on the pilot's instrument board warning of the fire and its location. He then pulls a lever releasing carbon dioxide at the point of danger. Similarly, thermostats detect overheating in tanks and flash a warning if overheating occurs as air compressors "blow out" the big guns of a warship after firing.

Life in the jungle is not quite the nightmare it might be because the refrigerator engineers, when they quit making refrigerators, didn't simply go home and sulk. Not that they contrived air conditioning for

the hammocks on Guadalcanal. They turned from making ice cubes to murdering mosquitoes.

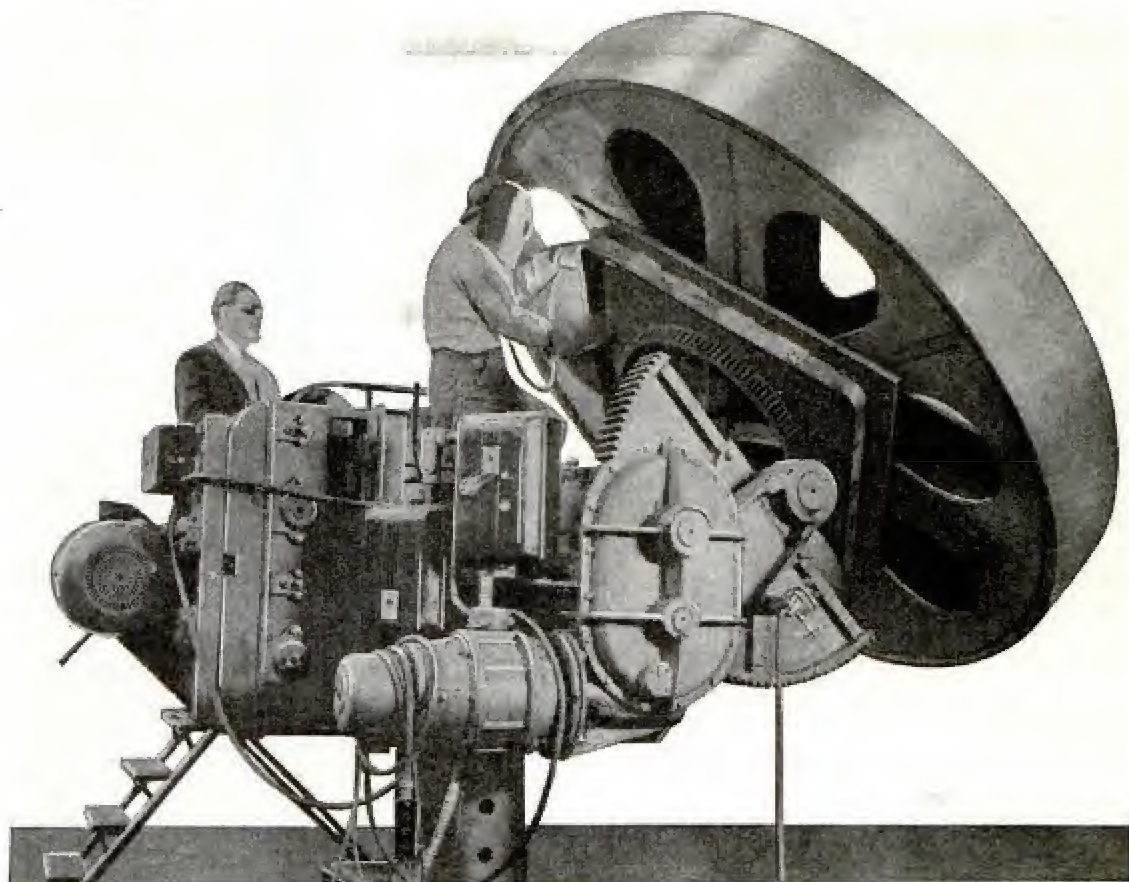
Years ago a Westinghouse man helped design a "charging bomb" which held the exact amount of Freon refrigerant required to fill a single refrigerator system. When the unit was assembled the bomb was connected to it and Freon under pressure flowed into the refrigerator's arteries.

When the same engineer heard of the army's need for an insecticide gun he had the answer. He loaded the handy little bomb, about the size of a No. 2 can, with oil of sesame and pyrethrum—

deadly to bugs but harmless to man, and nonflammable—and used the Freon gas under pressure as an "explosive" charge. Released in barracks or hospital or pup tent, the bomb sprays the air with a penetrating fumigant that kills mosquitoes quickly, seeks out insects hiding in crevices. Even in a foxhole it will drive away the pests. Millions of the bombs have been distributed to fighters in the tropics. One "health bomb" in 12 to 14 minutes will fumigate 150,000 cubic feet, the equivalent of 240 pup tents or 50 giant bombers. The spray can be turned on and off, and will



Canned death for malarial mosquitoes comes in containers first used to charge refrigerators with Freon



clear the air in a pup tent in three seconds. You can be sure it will be hanging on the wall of your summer cottage, your cow barn or in your camp tent when the boys are back from Tokyo.

What might have been a taillight for your bicycle is now attached, with lamp and dry cell, to cargo parachutes so that paratroopers can find quickly the supplies dropped to them at night. From the heater unit of your electric range the engineers developed a thermostatically controlled heat gun which fires the explosive rivets used in aircraft fabrication. In a laboratory designed to test power line circuit-breakers, engineers fired painlessly-killed birds from high-velocity compressed air guns to test the impact resistance of airplane windshields. The new windshields have withstood the impact of a four-pound bird at 300 miles an hour, that of a 15-pound bird at more than 200 miles an hour.

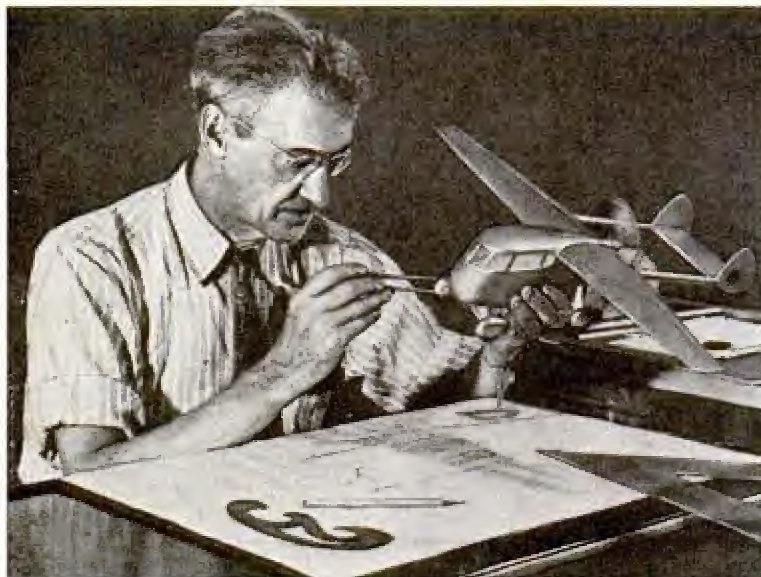
Emergency war problems get emergency treatment. American bombs delivered to an Allied air field would not fit bomb racks of British planes. American bomb racks would not accommodate British bombs. An adapter was needed desperately. A Westinghouse factory got the problem by telephone one afternoon. Designers put the adapter on paper while materials were

(Continued to page 150)

The manipulator above easily slips into any position the huge blank for bull gear of turbine-driven cargo ship, making welder's work easy. Below, the 97-ton metal monolith is a housing for steel rolling mill



Flying Air Car Designed With Hook-on Wings



W. B. Stout, shown above examining a model of his latest development, the "readable airplane," operates on the theory that accepted methods "ain't necessarily so." Among the "firsts" he has designed by breaking consciously with the past were the first thick-wing plane, first all-metal plane, and Scarab car, called "10 years ahead of its time"



Stout's Aerocar, the flying family auto, is to be equipped with "hook-on" wings, shown being installed above. Shown below is the Aerocar in flight. Unlike the readable plane, which is intended to be primarily a plane and secondarily a car, the Aerocar is, first, a good automobile



Stout's Aerocar would do 60 to 70 miles on the highway, and 100 miles an hour in the air with about the same gasoline consumption. Its air range would be about 250 miles. His readable plane would be for use in the West, where distances are longer, and would have a range of 400 miles in the air, coming to the ground only if the weather is bad, and remaining on the road only until the storm area is passed. Its wings would fold for road driving. It would speed at 120 m.p.h. in the air, 35 m.p.h. on the ground. Above is a third of Stout's conceptions for postwar travel, a Helicab. He considers it most practical for use in congested cities, especially for home-to-office commuters. Stout says he foresees electronic controls to prevent collision and constant ground-air communication



W. S. Silver Springs, Fla.

Navy Uses "Submarine" Camera To Film Diving Under Water



Navy cameraman goes to the bottom to film technique of diving

In the crystal waters at Silver Springs, Fla., a Navy cameraman was lowered to the bottom of a lake to film underwater sequences in a training film on the proper technique of diving. Himself wearing a diver's mask, but otherwise unencumbered, the cameraman hung half suspended beside his submarine camera, which was designed to protect film and operating equipment from water damage.

Plane De-Icer Heated by Exhaust Gas Keeps Wing at 60 Degrees

Thermal anti-icing, a system by which air warmed by the exhaust gases is blown through ducts onto wing and tail surfaces, has been installed on big bombers made by Consolidated Vultee. Exhaust gases, formerly wasted, heat the de-icing air through heat exchangers in the exhaust pipes. The air then is circulated through wing and tail surfaces. The heated air keeps the leading edges of the wings, where ice usually forms first, at 60 degrees when the outside temperature is 40 below zero. Its chief advantage over rubber pneumatic anti-icers is that the latter may alter the aerodynamic efficiency of the wing. Thermal anti-icing can be used in combat, at slow flying speeds, and during takeoffs and landings. The anti-icing effect begins as soon as the motors are started, and will begin instantly to remove ice that accumulated on a grounded airplane, which formerly had to be removed by hand.

Aircraft Corp.
-Davenport, Wis.

Postwar transportation, according to W. B. Stout, will rely largely on the aerocar, or flying automobile for families; the roadable airplane, for distance flight accompanied by short trips on the ground, and the helicab, a new type of helicopter. Stout, renowned engineer and designer, is now head of Stout Research Division of Consolidated Vultee. He believes the public is ready for such machines, and that industry is ready to provide them.

His aerocar is a three-passenger family model which takes wing for week-end or vacation trips. Weighing 1,500 pounds—half as much as a pre-war light coupe—it will be a good automobile first, and a plane only second, capable of speeds of 70 miles an hour on the highway and 100 in the air with pre-war gasoline consumption. Its cruising range would be 250 miles. To convert it to a plane, you let down wing and outrigger assembly, hook it on, and fly away.

His roadable plane will be a good airplane first, and a ground vehicle second. Light, weighing only 800 pounds, it would be capable of 400-mile cross-country hops, and could be used as a light delivery truck—say in areas of the West, where communities are far apart. It will do 120 miles an hour in the air, but only about 35 on the ground. To convert it from plane to car, you land it on the road, fold up the wings, and drive on.

These two models would be primarily for the Midwest and West; in the more congested Northeast, and indeed in any metropolitan area, Stout's "helicab" is designed to provide the nearest thing to personal wings yet devised. A helicopter type, designed to carry up to five persons, it would weigh about 1,700 pounds. He foresees a half-million helicopters taking commuters to Los Angeles and New York each morning, and back to their suburban homes each evening.

Aircraft Corp.
San Diego, Calif.

Giant Fan Exhausts Hot Gases At 242,000 Cu. Ft. a Minute

77496



Mammoth exhaust fan weighs 41,000 pounds, resists heat of 505 degrees F.

Used to supplement a sintering furnace that dries and purifies iron ore destined for making steel, a mammoth exhaust fan was constructed to resist operating temperatures of 505 degrees Fahrenheit. Each of four fans used in the operation exhausts 242,000 cubic feet of hot gases and abrasive dusts each minute. Each fan weighs 41,000 pounds, and measures 13 feet high, 20 feet long, and 14 feet wide. The enormous fan wheels turn in water-cooled bearings, to prevent lubrication from breaking down at the extreme high temperature.

'Remote' Compass in Wing Avoids Magnetism

77584

Remote-reading magnetic compass indicators and transmitters are being produced for warplanes. They make it possible to take compass readings from the airplane wing, or other points on the plane relatively free from magnetic influences. With the compass transmitter placed in the desired spot,

40 Designed & Produced
by Bendis Aviation
Division

the compass bearing is transmitted electrically to an instrument panel in the pilot's compartment. The complete unit of indicator and transmitter contains 206 parts, one a coil about the diameter of a thimble, but with 2,050 windings over 20 laminations of special metals.

Portable Darkroom Housed in a Box Two Feet Square

77511

Army, Navy and Marine photographers can "carry darkness" in their hands in the form of a handy portable darkroom. This military model, which will probably be adapted to postwar civilian use, consists of a box less than two feet square that contains all materials necessary to take and process pictures. Its contents include camera, lenses and filters, film, flash synchronizer, batteries and cable release. In compact shelves and compartments are chemicals, trays, timer, clips, thermometer, daylight loading tank, portable miniature enlarger and other equipment for developing and printing. The necessary electric current can be supplied by an auto battery.

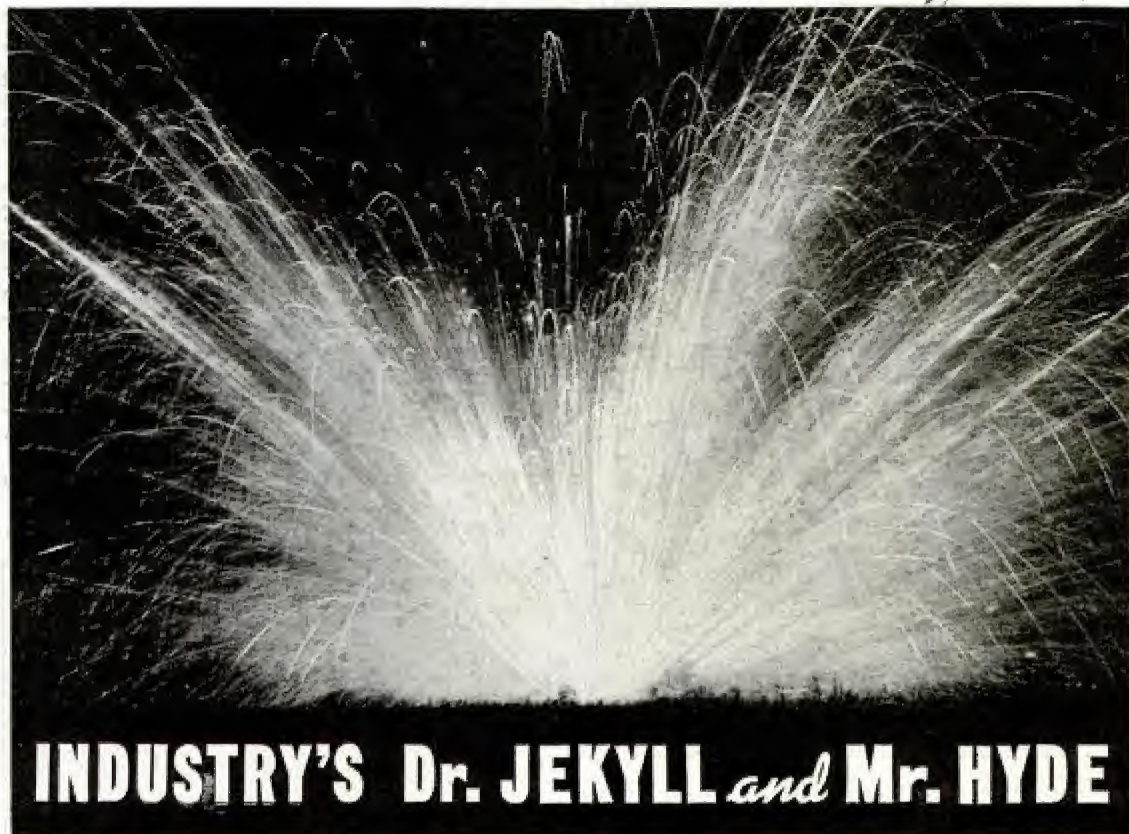


Darkroom box for military use holds a camera and equipment

William J. Wideman (author) S. C. White
N. H. B. Co., Kalamazoo, Mich.

Clayton Fox Co.
Kalamazoo, Mich.

Eastman Kodak Co., Rochester, N. Y.



INDUSTRY'S Dr. JEKYLL *and* Mr. HYDE

IN THE family of the elements, phosphorus leads a double life. Essential both to plants and animals, in an elemental form it is a deadly poison; it goes into soap and smoke screens, biscuits and bombs. It will burn on contact with the air, yet it makes theater curtains fireproof; an excellent drying agent, it is always manufactured and shipped under water.

It mothproofs clothing, makes oil and water mix, and in one combination you even rub it in your hair; it also could burn down cities.

The Greeks had a word for it—"light bearer," from its quality of glowing in the dark. To a modern age, it might better be described as both a Dr. Jekyll and a Mr. Hyde—obliging partner of industry in peace, and a fearsome adjunct of armies in war.

Phosphorus has already gone to war in huge quantities. It is ideal for smoke screens, providing a screen with the highest obscuring

Phosphorus in wartime is an incendiary and screening agent. Above, a nighttime burst of white phosphorus; below, mortar crew lays a smoke screen. In other forms phosphorus goes into food, feed and fertilizer



Washington, D.C.



An ideal screening smoke, according to the Chemical Warfare Service, should produce a cloud of finely divided particles to shield men and equipment. Actually, the screening is produced not by obstructing light rays, but rather by reflecting light. For this reason, white smokes are preferable to black, because the white reflects and even blinds. *Mo.*

White phosphorus, or "WP" in the Chemical Warfare Service designation, is a pale yellow, waxy solid that combines actively with oxygen to form phosphorus pentoxide. The reaction, accompanied by a smell as of burning matches, produces a flame that will set afire equipment and injure men. *Lancie*

As dicalcium phosphate, phosphorus goes into tooth paste, shown in manufacture at left. Below, phosphate rock open-pit mine of Monsanto Chemical Co. *St.*

power of all the known smoke materials.

Smoke is a common weapon of this war. The Germans used it against the Fortress Eben Emael in Belgium and against the Maginot Line; the Axis used "artificial fog" in the attack on Crete; smoke screened effectively our landings in North Africa. Civilian defense units have experimented with smoke to "white out" whole areas in the event of daytime air raids.

Below: application of fertilizer. Triple superphosphate provides readily assimilated food for plants



The substance is loaded directly into shell, bomb or grenade by melting it under hot water and casting it in the projectiles. When the projectile explodes the solid phosphorus is scattered into the air, forming a bright cloud of burning particles. The pentoxide remaining maintains the screening effect, and is harmless to men or materiel.

Because of this wide dispersal of burning particles, WP may also be used as an incendiary. The particles ignite spontaneously in the atmosphere, and treatment of burning phosphorus on the skin is an extremely difficult job.

Dousing the burn with water immediately extinguishes the flame; but when the water dries the particles flare again. Immersed in water, the tiny firebrands may be removed from the skin, though it is difficult to prevent minute segments from remaining. Preferably, the burn is bathed in copper sulfate, which forms a coating around the particle, excluding oxygen and stopping the burning action, until the particle can be efficiently removed.

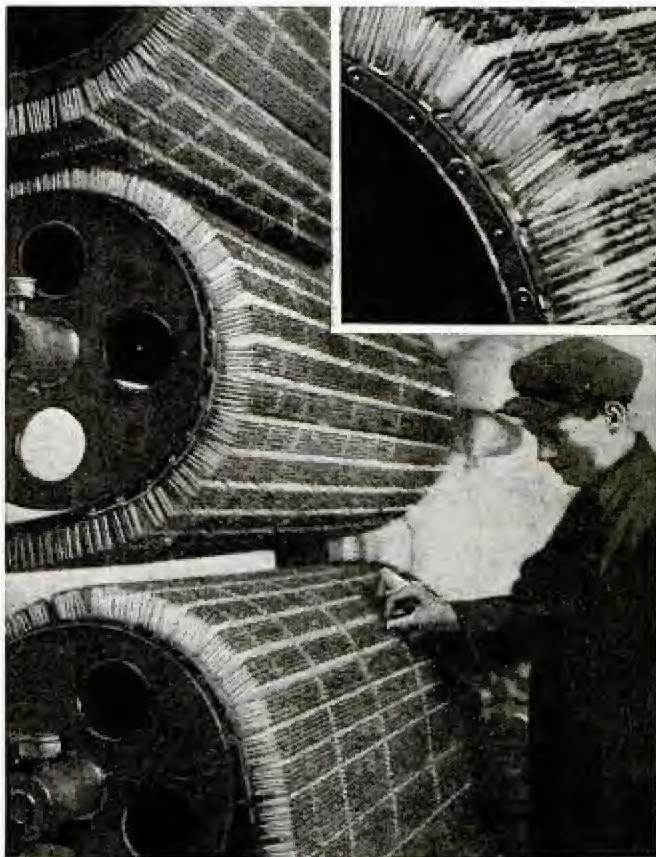
The Japs use phosphorus in a delayed-action explosive-incendiary bomb. Around a central exploder tube is a liquid-filled chamber in which float numerous black rubber cylinders, which are filled with phosphorus. On exploding, the bomb scatters the rubber pellets widespread. A fire spotter would not suspect an incendiary was present until the pellets dry. Then the phosphorus ignites the rubber, causing stubborn, persistent flames.

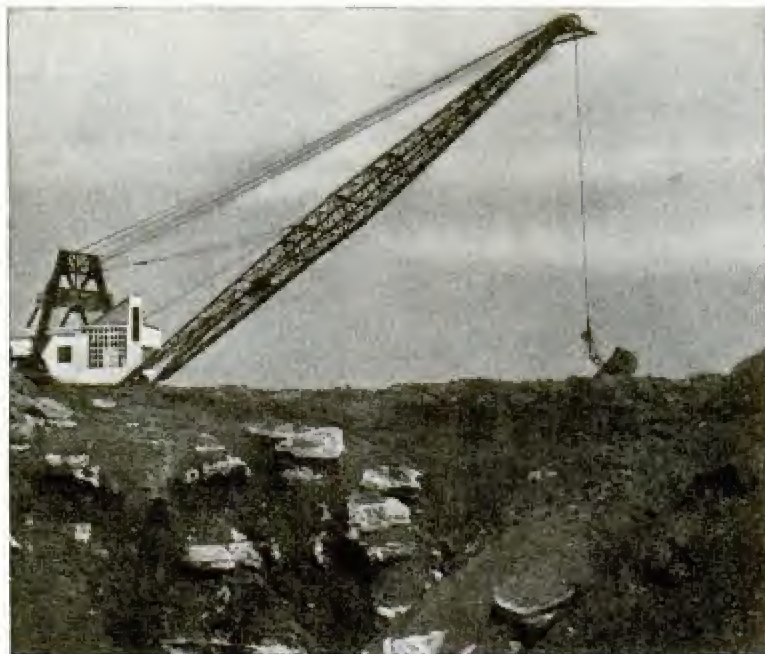
For all its spectacular, wartime "Mr. Hyde" character, phosphorus is as unimpeachable as Dr. Jekyll himself in peacetime pursuits.

Though it never occurs free in nature, phosphorus is the 12th element in order of abundance in the earth's surface, according to the United States Department of Commerce. Concentrations of phosphorus compounds, principally calcium phosphate in mineral rocks, exist in many parts of the world. In the United States the mineral is chiefly mined in Florida and Tennessee, and to lesser extents in Idaho, Montana and Virginia. It is a prime element in the composition of bones,



Above: Monsanto Chemical Co. workman filling tank car with molten elemental phosphorus wears asbestos suit as a safeguard against fire. Below, phosphorus makes matches flame
Ewing-Galloway photo





From Monsanto's open-pit mine comes phosphate ore to be processed into elemental phosphorus, starting point in the making of phosphoric acid

and deposits of fossilized bones formerly were a chief source.

The phosphate rock, together with sand and coke, is heated at very high temperatures in an electric furnace. Elemental phosphorus is thereby distilled off in gaseous form, then condensed and collected under water as a solid substance, or immediately burned to phosphorus pentoxide. From the latter is derived phosphoric acid and phosphatic derivatives.

ble under 350 degrees Centigrade, and is not poisonous.

The element's dual personality is shown in the common match. Whereas its flaming tip may be made of sesquisulphide of phosphorus, the match stick itself is treated with another phosphorus compound—monoammonium phosphate—to eliminate afterglow. This same compound renders wood, paper and textiles fireproof. Thus, in one form phosphorus causes fire; in another, it prevents it.

Monoammonium phosphate also keeps candlewicks from smoking, and helps make yeast, vinegar and bread-improvers.

Phosphates became the first chemical fertilizers, as contrasted with organic manures. The importance of phosphates to successful farming is shown by experiments of the Tennessee Valley Authority. The Central Basin of Mid-Tennessee contains soils almost as fertile as any in the United States—land naturally rich in all nutrients needed by plants, and especially in available phos-



Tapping molten silica slag from bottom of an electric phosphorus furnace at Monsanto's plant in Tennessee

phorus. By contrast, the Highland Rim surrounding that same basin has soil with markedly less of such nutrients.

A visitor doesn't see the difference as one of soil. He sees a contrast between the rich, broad, fertile acres of the Central Basin, with its well-kept homes and prosperous people, and the gullied, meagerly covered hillsides, with their picturesque, but often poor, homes. When Gary Cooper as "Sergeant York" hankered after "bottom land," he was all unknowingly longing for soil containing more available phosphorus, you might say.

Cattle fed on the phosphate-rich hay from the Central Basin grow heavier than those of the Highland Rim; in the basin are 81 animals per square mile, in the adjoining hills, only 23. Cattle on experimental tracts would even avoid untreated land, while keeping that treated with phosphates closely cropped. As to erosion, plant cover is a principal means of keeping the soil bound together, and phosphates make plants grow.

In test demonstrations of phosphating soils over five years, the TVA reported that production of hay was increased by one-third; production of small grains by two-thirds; of corn by one-fourth. Acreage of cotton and tobacco remained about the same, but production jumped by one half; sales of whole milk and eggs increased by one half; wool sales by one-fifth, and hog sales by two-thirds.

Especially in humid parts of the United States, the TVA believes, phosphorus is vital for successful farming. On most soils it is needed to make possible soil-conserving systems of farming. It makes legumes grow, and legumes transfer another needed nutrient, nitrogen, from the air to the soil.

Object of any fertilizer is to get plant food into the soil in such a form that the plants can feed on it. The phosphorus in phosphate rock is insoluble, but more than a century ago in England Sir John Laws found that by treating ground rock phosphate with sulphuric acid he could make the plant nutrient available. Laws' "wet process" produces superphosphate with about 8 percent phosphorus; this percentage can be more than doubled by treating the pulverized phosphate rock with phosphoric acid, which further concentrates the phosphorus.

Phosphoric acid is also used to rustproof metals. Other derivatives of the element are used to treat textiles chemically to prepare them for dyeing and finishing; to improve the effectiveness of both household and industrial soaps; as a water softener and cleaner; as a metal degreaser; as an acid neutralizer.

(Continued to page 150)

NOVEMBER, 1943

Robert Heath, Inc.
344 Baltimore
Kansas City, Mo. 71466
Candle-Lit Heater for Dish
Keeps Supper Warm

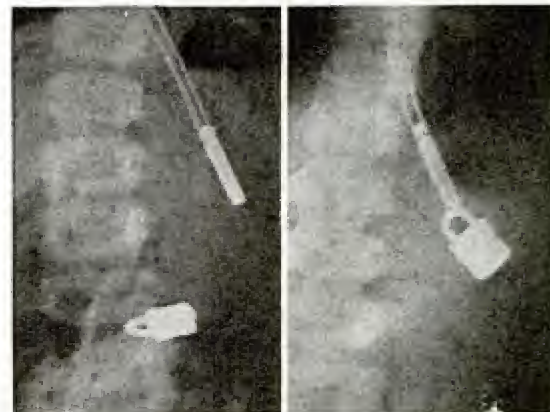


Heat from candle keeps buffet dishes warm until use

Especially suited for buffet dinners, when guests may linger overlong after the first call to the meal, is a dish heater, whose warmth comes from a stubby candle enclosed in a glass base. Heat from the candle is just enough to keep a pot, pan or casserole dish warm for the tardy eater.

71489
Magnet Is Lowered Into Stomach
To Remove Metal Objects

Small metal objects, such as a child might swallow, can be removed from the stomach with a tiny magnet. This revolutionary medical procedure recently averted a surgical operation on a five-year-old boy who had swallowed a padlock. The magnet was lowered into his stomach and the padlock was slowly and safely withdrawn.



X-ray photos show padlock being taken from stomach

Dr. Samuel Silber
Brooklyn, N. Y. 45

WAR MAPS WHILE YOU WAIT



↑ Officers of the army War Plans Division study a world map as Brig. Gen. Leonard T. Gerow, division chief, points to a scene of operations. Map-making for the Army, Navy and Air Forces is a big industry in which American business machines and printing equipment have proved of outstanding value. Data for map-making are obtained by plane, patrol and reconnaissance, brought in by radio, telephone or courier and experts quickly compile and print the maps with duplicating machines, lithograph presses, mimeograph and multigraph. Some machines turn out multi-color maps. In the battle of Egypt quick changes in maps were made by using green carbon for allied positions, red for the enemy



↑ A sergeant of the U. S. Army engineers making a military map in the field prints a lithographic plate in an offset press. Fast duplication is necessary to supply all ground and air units with up-to-the-minute maps in quick time



← On the wall of field headquarters a master map of the battle zone is mounted, the lines changing as phone, radio or plane reports tell of advances or withdrawals. Strategic movements are plotted on the transparent overlay

*Sgt Meyer
Funkelstein
Buffalo, N.Y.*



† Aerial photographs taken from various angles at high altitudes are matched into a large strip mosaic map. Sometimes three-dimensional maps are made, revealing the heights of objects seen under stereoscope

At center, retouching prominent features of terrain, battle lines and enemy positions on the negative of a battle map preparatory to making a lithograph (or planograph) plate for map-printing press



*Col. Lo Nunn
Grant Hall
Fort Leavenworth
Kansas*



Above, a colonel demonstrates on huge wall map how an infantry attack is planned, while staff officers of a division look on. Charts used by pilots and navigators in Air Forces are fluorescent, details becoming visible under rays of ultraviolet lamp worn on forehead. Below, plotting gun ranges from telephoned data



71522

Capless Pen Retracts Nib And Adjusts for Altitude



Pen has stratosphere "shift"; inset, nib retracted

You can write at sea level, on a mountain top or in a stratosphere with a fountain pen that has three "shifts" that control air pressure within the ink compartment, according to its inventor. The pen has a retracting nib which is sealed with a special device when withdrawn, eliminating the need for a cap. When the pen is in "low gear" with nib partly extended for use at extremely high altitudes the ink reservoir remains sealed air tight, but when fully extended for use at normal altitudes both the ink and air ducts are open. The pen is filled with a hydro-pneumatic trigger.

Collapse of Roof of Voice Box May Cause Bomb-Blast Death

Untold numbers of persons have died in bombing raids without ever being touched by a bomb or its fragments. Death has been ascribed to blast, but exactly how it occurred is in dispute. Dr. F. E. Eve of Eng-

land believes death may be due to the forcible jamming shut of the epiglottis while the lungs are empty, with consequent suffocation. The epiglottis is the lid, or roof, of the voice box. When a bomb explodes, its high-pressure wave, in air or water, compresses the chest, forcing out some air, but the chest, being elastic, then expands, and air is drawn sharply inward. This inrush of air might slam down the epiglottis, and this effect would be reinforced by the low-pressure wave of the blast, which sucks the chest walls outward just as it sucks glass out of windows. If the lid of the voice box is jammed shut this way, when there is only a little air in the lungs, the victim cannot force it open, because he has not enough air in his lungs to provide sufficient pressure. Nor can air enter his lungs, so the victim swiftly dies. To answer the objection that blast victims show no sign of suffocation, Dr. Eve cites three cases of sudden death due to food jammed in the upper part of the windpipe. Victims in these cases did not turn blue or show signs of choking. For possible prevention of blast death, he advises wearing a broad stomacher, which need not be very tight but must be elastic.

71475

Punch Slides Inside Metal Sleeve To Locate Center of Hole

Centered within a sleeve that fits snugly in a template hole, an aircraft worker's transfer punch locates the exact center of the hole. It is claimed to be a boon to the inexperienced operator. The punch also eliminates wear of the template holes since there is no friction between the tool and the hole. After being struck with a hammer, the punch withdraws automatically and is in position for the next punch.



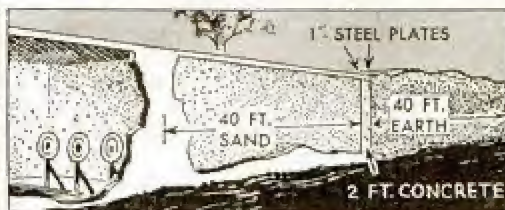
After hammer blow, punch withdraws automatically

Andrews Pen Co.
1435 W. 25th St.
Los Angeles, Calif.

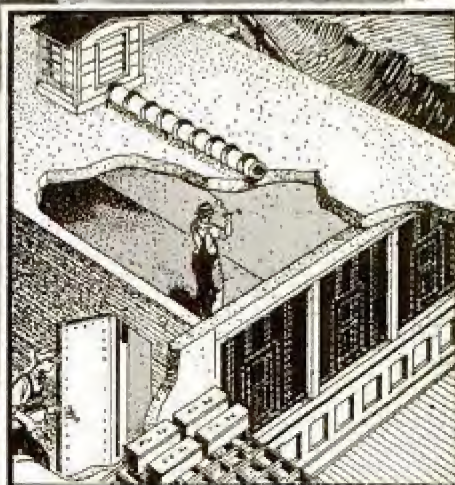
Giant Firing Range Has Glass-Floored Turret N 458 Wm. Whittaker



Observer looks through glass floor of booth on roof and reports on the quality of flashing tracer bullets



TWO BLOWERS, ONE AT EACH END, CLEAR RANGE OF GAS AND SMOKE

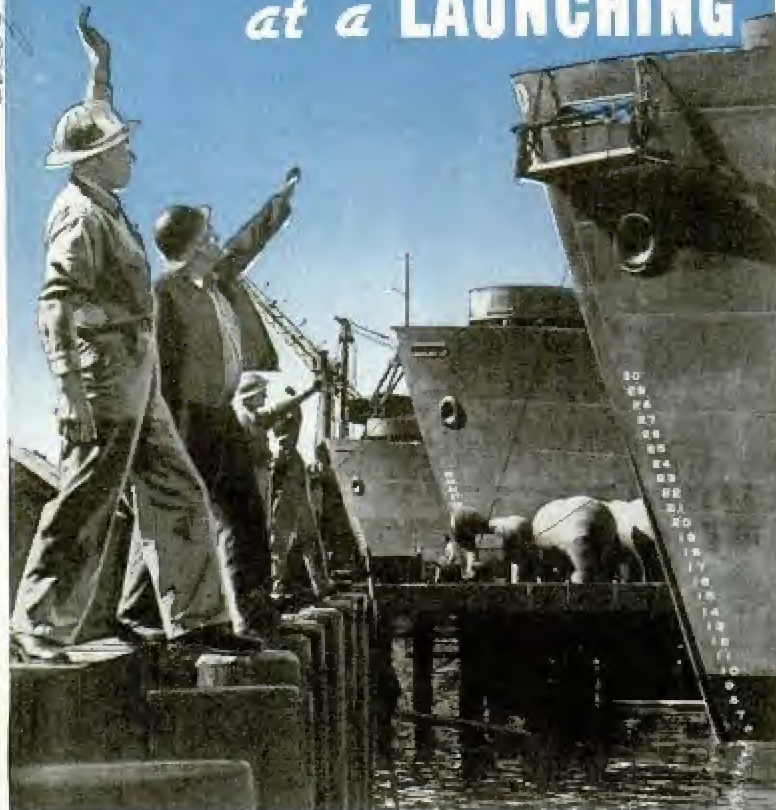


Built of concrete, the world's longest enclosed firing range is 1,800 feet in length. Above, firing ports close automatically when door leading into firing range is opened by maintenance men

Thousands of ball, tracer and armor piercing cartridges are tested daily in an 1,800-foot soundproof firing range constructed by the Remington Arms Company near Bridgeport, Conn. It is believed to be the longest enclosed firing range in the world. An unusual feature of the range, which is built of solid concrete, is its three tracer observation turrets spaced at 125, 250 and 500-yard intervals. Through a bul-

letproof glass floor, observers study the fiery trail of the bullets and make their reports by telephone. The range, designed to meet exacting standards of the armed forces, gauges accuracy and velocity for every caliber of small arms ammunition from the .22 rifle to the .50 caliber machine gun. The .50 caliber bullet strikes the target 1,800 feet away in slightly more than half a second after it leaves the gun.

BEHIND *the* SCENES at a LAUNCHING



Though they're safely in the water now, each of these Liberty ships gave launching master endless headaches before they charged down the ways

IT TAKES 100 tons of dirt, \$14,000 worth of timber, and a deep sea diver, among other items, to launch a big Liberty ship. It takes a whole lot of things that the spectators who witness the launching ceremony at the bow never dream about. Mainly it takes timing and team work on the part of the launching crew.

To the spectators the launching of a ship is a thrilling event. To the launching master it is a time of anxiety. The ship might tear itself loose prematurely or it might refuse to move at all. The greased ways might catch fire from friction. Men might be killed by timbers spewed forth from under the ship. The vessel might turn over when it hits the water. All these things have happened in the past.

But not one launching accident has marred the record of the California Shipbuilding

As a variant on launching procedure, a sponsor belts cartooned Fuehrer's nose

Corporation, where some 300 big ocean-going ships have been built since September, 1941. Moored in a line bow to stern these ships would make a floating bridge more than 25 miles long. On the ways, one of these ships compares with a good-sized office building laid over on its side. Although far from finished at the time of launching, each weighs thousands of tons.

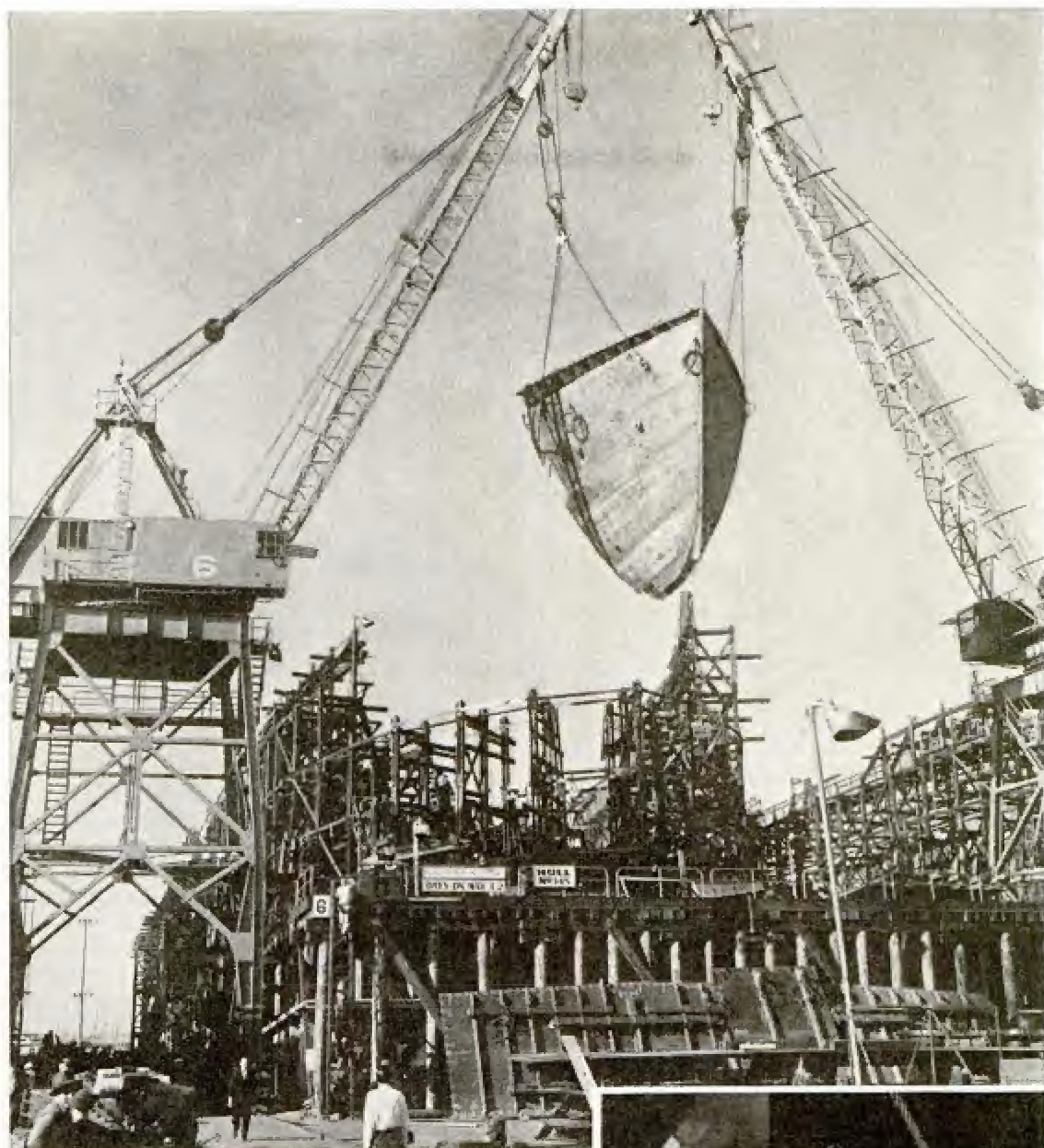
Many different schemes have been used for launching big ships in the past. One old-time method was to hold the ship in place with huge timber triggers, each trigger being secured by a hawser. Axmen were stationed by each rope, ready to slash it at the launching master's whistle.

At Cal Ship and at many other yards today the "burning plate" method is used. That is, the sliding ways that serve as runners under the ship are attached by wide steel plates to pilings driven deep into the ground. At the moment of launching these plates

are the only things that tie the ship to the shore. Then the plates are cut with torches, releasing the vessel.

In spite of its great bulk and tremendous weight, the imparting of life and movement to a new ship is an extremely delicate





Gantry cranes above lift completed ship's bow into place on ways. Right, applying a grease coat to permanent way

procedure. Jim Lewis, Cal Ship's launching master who has personally supervised the launching of every vessel built at the yards, begins his task a good four days before a new ship is ready to enter the water.

To begin with, the ship was assembled above two permanent ways, or tracks, that have a 15 degree slope toward the water. The whole ship was built at this angle. During the first stages of construction the keel and bottom were supported a number of feet above the permanent ways by frames which were later replaced by shoring as the ship grew. The launching master's job is to place sliding ways under the ship, resting on the greased permanent ways, so that the ship and the sliding ways can slide down to





At time of launching, only two steel plates hold ship to shore. Burned apart, they free ship for its plunge

the water. Likewise, he attaches drags to the ship so that it will come to a stop after it has been launched.

Jim Lewis begins the launching process by installing heavy wooden cribbing under the ship to support its weight, then removes the shoring that had held it up. Next the permanent ways are greased with a coat of thick grease topped off with a slip coat of lighter material. Two tons of grease go into the five-eighths of an inch layer.

Now the flanged sliding ways, that will serve as a sled to hold the ship, are laid on top of the greased permanent ways and are attached to the ship by cables and wooden contour blocks and packing. The shore end

of each sliding way is bolted to its burning plate. A wooden mask is built out from each side of the vessel's stern to act as a drag when it hits the water.

In wide timber troughs along each side of the ship, chunks of chain weighing up to 14 tons each are connected by steel cable, one end of each cable being attached to the ship. These are the drags that will bring the ship to a stop within a few lengths after it enters the water. Tons of dirt are dumped into each trough to increase the drag of the chains.

Possibly 150 men in all take part in the launching procedure. The launching will be half an hour before high tide, no matter

whether this occurs at two in the afternoon, 11 at night, or three in the morning. An after-dark launching is one of the few occasions on which the American flag is flown by a ship after dark.

The launching crew has dozens of tasks to perform during the last few hours, and each job must be done according to a minute-by-minute schedule that is prepared ahead of time. Even one deviation might hold up the launching, forcing postponement



Below hull, launching party rams home wooden wedges that let the ship rest on the sliding ways

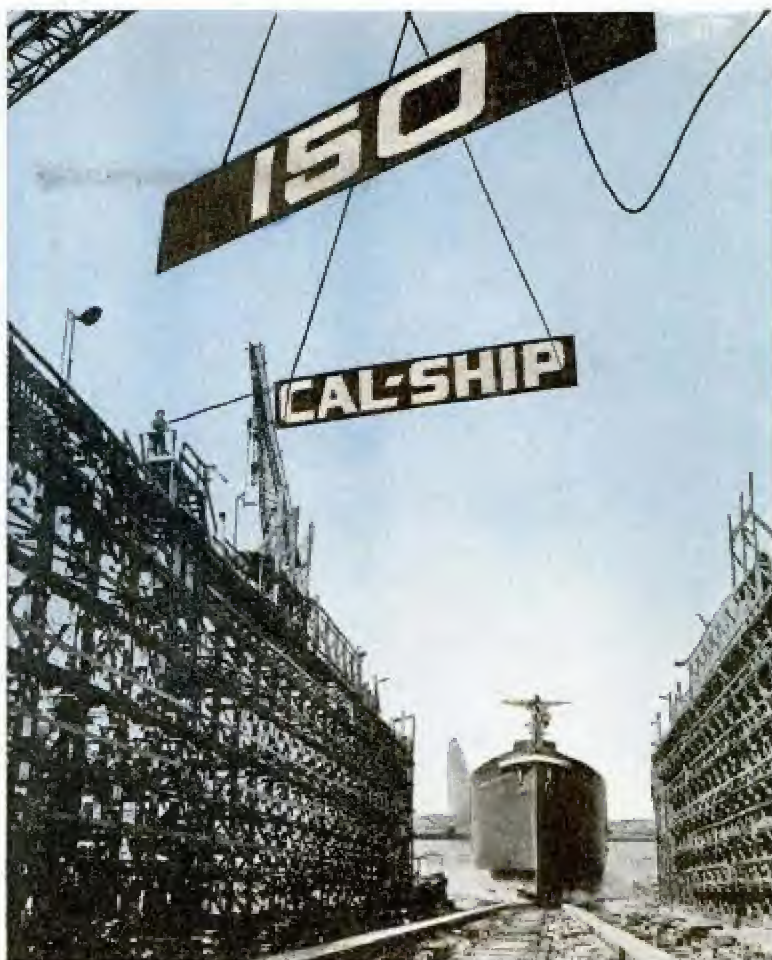
until the next high tide and thus delaying the start of construction of another ship.

While spectators are gathering under the bow to listen to the speeches and to watch the christening ceremony, teams of men are finishing their work. All electric leads and air hoses are disconnected from the ship, gantry cranes remove heavy tools and equipment from it, loose material on deck is lashed down, all hull openings are inspected to make certain that they are closed, and the launching party that will ride the ship, in charge of Leonard Radford, goes on board. Stowaways, if any, are routed out and sent ashore. All ramps and staging leading to the ship are removed.

By now, gangs of men under the ship have teamed up to swing heavy wooden rams that hammer big wedges into spaces above the sliding ways. These wedges do two things. They lift the ship up off the cribbing that supported it, thus placing its weight on the two sliding ways. The cribbing is removed, the two dog shores still attached to the hull are released, and now the ship is held to the land only by the steel plate at the end of each sliding way.

These plates have been partially severed by a line of holes drilled across each. The metal between each two holes is identified by a painted number. Cutting torches have been lit and at the command "Burn One!" the burners cut through the first section of metal. Port and starboard burners work in unison so that each plate is weakened at the same rate.

"Burn Two!" "Burn Three!"



Ships at launchings have been known to tear themselves loose prematurely, or even turn turtle; ways have burned; flying timbers have killed. But a perfect launching looks like that above, the 150th at Cal Ship, which has not had a launching accident. Below, welders at work in yard plate shop





One of the last tasks before a launching is the painting of the bottom of the hull, above. Right, hoisting broom to masthead marks the successful completion of the new vessel's trial run

The remaining metal snaps apart and the ship slowly begins its slide. There's a smell of champagne from the broken christening bottle, swung by the sponsor from a platform above the heads of the launching crew, and every whistle in the yard screams a salute to the new ship.

Out in the channel, the drag chains are bringing the floating hull to a stop and the tugs are nosing in to guide it to the outfitting dock where the work of installing the ship's machinery will be finished.

Sundry blocks and timbers that made up the launching sled are floating in the water around the hull and a debris boat comes out to gather these up. In the old days such timber was appropriated by beach combers but today this lumber costs \$14,000 and will be used again and again to launch other ships. At the outfitting dock, a diver is sent down to release any of the timber that might be caught under the bilge keels of the ship.

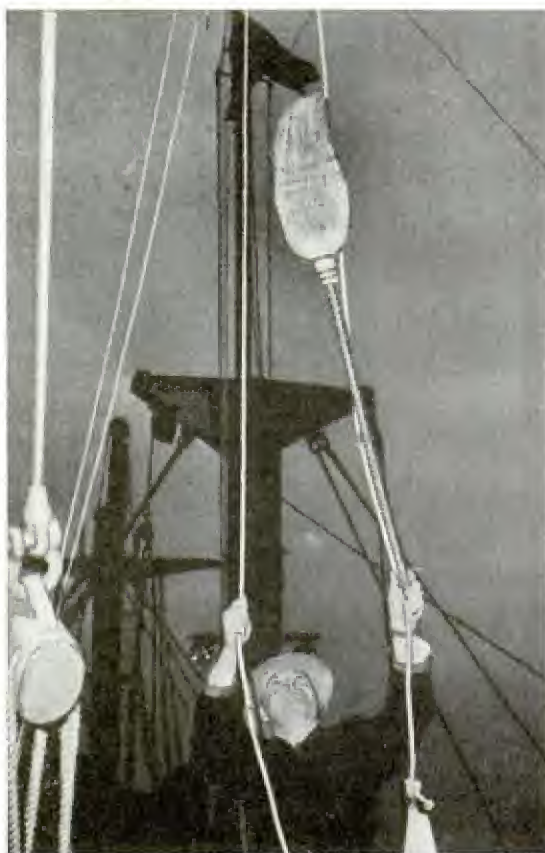
Among the things connected with the launching that had to be calculated and controlled was the top speed that the ship would attain in moving down the ways. A ship that slides into the water too fast may break away from its drag chains and run wild, damaging other vessels as well as itself. A ship that moves too slowly could break her back at the time the stern is sup-

ported by the water and the bow still rests on the ways.

At Cal Ship a launched vessel attains an average high speed of 20 miles per hour on the ways. It moves fastest if the temperature is moderate, slowest if the temperature is unusually hot or unusually cold. This is because a cold day stiffens the launching grease, while a hot day softens the slip coat of grease and allows some of it to squeeze out from the pressure.

Just because our Liberty ships are being mass-produced, don't think for a minute that they aren't staunch, capable vessels. They are big ships of 14,500 tons loaded displacement, able to hold their own in regular round-the-world service. Today they are plowing through every one of the seven seas, from the Arctic to the Antarctic.

By the beginning of 1944 Cal Ship as well as other yards will be in production on two more mass-produced types. One of these will be a tanker of moderate size, and the other will be the new Victory ship class, essentially an enlarged, improved, and faster version of the Liberty ship.



The "FORTY-NINERS" of '43



Dump cars laden with ore emerge from Benbow Mine, first of the chromite mines in the Beartooth range of Montana to begin war production. Ten cars are drawn by battery-driven locomotive.

CHROMIUM turns up in the most inconvenient places. Hard rock miners fighting blizzards 8,000 feet up in the Beartooth mountains of Montana say "Any place we get it, chrome's way up in the air. It runs to altitude."

But any place in America would be convenient to find the ore right now, for chromium stands second in the list of strategic minerals essential for war. Once the shining metal of your automobile trim and the alloy that hardened steel for tools, dies, and fatigue-resisting gears and springs, chromium today is the stuff of battleships, cruisers and destroyers, of armor-plated tanks and of armor-piercing shells, of airplane crankshafts, truck axles and big guns.

The outlook until quite recently was not nearly so bright as the metal itself. Our chromium requirements have tripled since 1939. In 1940 we consumed 657,689 tons, but produced only 2,666 tons from domestic ore. Of the 1,000,000 to 1,300,000 tons of world production before the war, Russia produced 20 percent in 1936; Rhodesia led with 275,000 tons in 1937; Turkey was top producer in 1938 with 213,000 tons and in 1939 with 191,000 tons. Philippine production reached 194,000 tons in 1940. Now

these sources are cut off completely or made dangerously remote by the hazards of war at sea.

Fortunately the miners in the Beartooth range, and others working the low-grade deposits in California and Oregon, are winning America's fight for chromium. Production in 1943 may equal prewar imports.

The fight has not been easy. The miners and mill workers are doing a tough job, in typical pioneer fashion, working and living in high Rocky Mountain country that until now has seen only an occasional prospector or hunter after deer or elk or bighorn sheep. The chromium operations are owned by the United States government and managed at the government's request by the Anaconda Copper Mining Co. The most important mining levels are more than a mile and a half above sea level. The deep snows of winter clog the passes through which miners and engineers must travel, until summer has arrived in the plains below. In August, 1942, there were not four days without snow. In July there was a six-inch fall.

Supplies for the miners, all the materials and heavy machinery for the operations, must be trucked in over steep new roads,



Chrome-steel armor plate nearly an inch thick is pierced by high-velocity .50-caliber chrome-steel bullets at 200 yards

treacherous with ice, snow and rock slides. The men who cleared the way and started camp construction worked sometimes in waist-deep snow at temperatures 30 below zero. America had to have chromium.

The original Beartooth claims were staked out nearly a half century ago by a veteran prospector, Thomas Benbow, but the low-grade chromite ores were not regarded as commercially workable until the war came along and the government assigned to Anaconda mining engineers the job of exploring the deposits, devising fea-

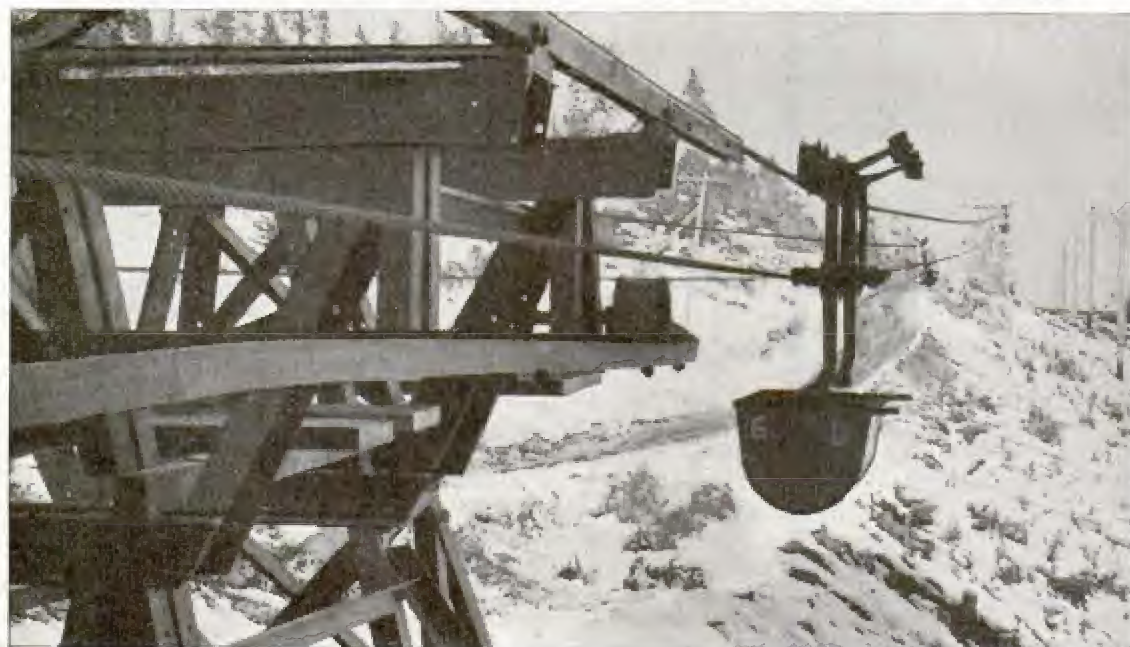
ible methods of mining and concentrating the ore, and then building and operating the plant.

In its crude form, chromite—the ore of chromium—is black, and filled with glittering, light-catching crystals. Crushed and concentrated, the chromite resembles a fine black sand, and contains about 40 percent chromic acid in combination with iron oxide. In producing some steels, this 40 percent chromic oxide concentration can be used as it is. In making ferrochromium for higher grades of tough, shock-resistant steels, the chromium content is further concentrated in relation to the iron content by fusing the ore with lime in electric furnaces, leaching with water and using the product of the leaching to treat other 40 percent chromic oxide concentrates.

Some of the deposits in the Benbow mine lie 8,500 feet above the sea. From the mine and the first crusher, the ore rides an aerial tramway on a dizzy journey over peaks and down valleys to the mill, two and a half miles away and 2,500 feet lower. It travels in buckets carrying 1,200 pounds each, and sometimes a repair man will stow away aboard one of the buckets for a dizzy, swaying ride, part of the time swinging through space a thousand feet above a valley floor.

The miners and engineers may keep their feet on the ground, but their approach to the upper camps is almost as dizzy.

An ore bucket filled with chromite travels by aerial cableway from tram house at Benbow Mine to the mill, two and one-half miles distant by air line and 2,500 feet down the mountain





Here chromium plays its essential wartime roles as a toughening alloy of steel. At top, the new amphibian jeep and a 16-inch coast defense gun. Center, an army glider takes off from Ford airport under tow; at right, an M-10 tank destroyer ready to test its chrome-steel hide. Below, the U.S.S. Pennsylvania firing a broadside



Roads just carved from the mountain sides climb grades as high as 25 percent; Caterpillar tractors can make the pull with heavy loads, as can ten-wheel-drive trucks. Passenger cars can make it in good weather, but it snows every month.

Metallic chromium was first produced in 1791, was first alloyed with steel in 1821, but only the metallurgical research and experimentation of the last generation gave

it importance. In the years before the war chromium became a vital hardening agent. Better drills, chisels and files were made of chrome steel than had ever been made before. It became the basis of harder dies, of chrome steel springs and gears that wore longer. Chromium cast iron proved more abrasion-resistant and had more thermal stability than most other ferrous metals. Steels made stainless by the addition of

Don Fager
Jim Gaud



Raising an 18-inch cap timber in a tunnel of the Mout mine

chromium were used wherever acid-resistance was a factor, as in food handling and chemical plants. Its brightness as well as its resistance to weathering, and the fact that chromium steels are easily fabricated by welding or spinning, gave the metal its vogue in architectural trim, tableware and automobile brightwork. It was used in surgeons' instruments because of its ability to hold an edge and resist oxidation.

Chromium also serves as a refractory, in electroplating, in chemicals for dyeing, in tanning (chrome leather) and in paints and pigments.

But chromium is in uniform, now. The shafts that drive the tanks, the gears that turn the tracks, the armor that protects the crew are all made of steel hardened and toughened by chromium. The cams that drive the battleship, the heavy walls that shield gun turret and fire control centers are of chromium steel. The castings and

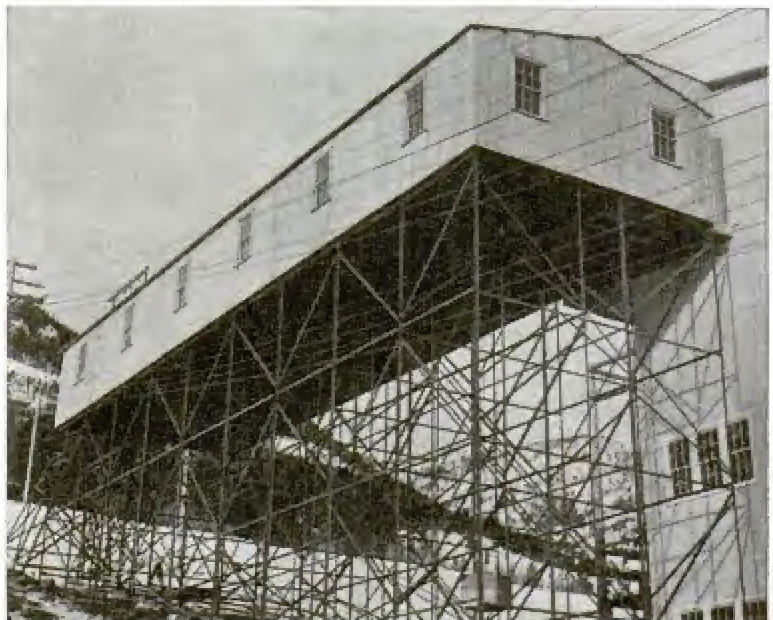
At this tram house at the mill of the Benbow mine the buckets carrying 1,200 pounds of ore end their two and a half mile journey over aerial cableway

pistons and the light armor that saves our fighter plane pilots are all of this tough stuff, and the hardened tools that drill and shape the materiel of war are chromium steel, too. A steel foundry in India has developed a super-hard alloy of iron, chrome and molybdenum, a sheet of which, .39 inch thick, will stop a bullet fired 131 feet away with a velocity of a half mile per second. Of such stuff, shell-resistant tanks could be built lighter, saving material and fuel, and vital changes might be made in the design of planes and ships.

In the past, less than one percent of the chromite used in the United States was produced here. The war has changed that.

Unfortunately Japan now controls the great Philippine mines that once provided one-fourth of our needs. Those mines alone are adequate for Japanese needs. Germany has depended on Turkey and other foreign sources, and now controls low-quality ore in Yugoslavia and Greece.

Some ore may still reach us from Turkey, South Africa, Cuba and New Caledonia, but it is the hard rock miners of our own west who are digging out the bulk of the glittering stuff that toughens the hide of our new battlewagons and stiffens their 16-inch guns. They are tackling and beating as tough a job as was the conquest of the Klondike, and it was the ingenuity of American engineers in finding processes for refining this low-grade ore that made their job worth doing.



*James S. Cobb, Jr.
Delta Air Lines
Atlanta, Ga.*

77462

"Venetian Blinds" for Cockpit Aid in Training

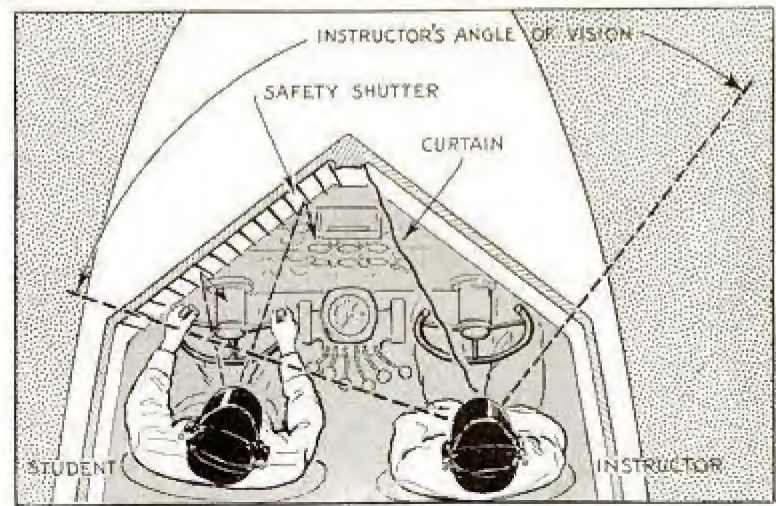
Practice in blind flying has been admittedly hazardous because frequently the device used to cut off the student pilot's vision also blinded the instructor. Thus, the plane flew without any lookout to guard against collisions. Delta Air Lines has offered the armed services a development of a senior pilot, Capt. Edward F. Smith, which eliminates that hazard. It is a series of shutters, installed in the cockpit window on the student pilot's side in such a fashion that he cannot see out, but the instructor, sitting beside him, can. A vertical cloth curtain is hung near the instructor between the two seats, with an opening for his head. This blocks the student's view out of the other window, but not the instructor's. In effect, the pilot is forced to fly "on instruments," while his instructor has virtually unobstructed vision out of both sides of the cockpit.

H. B. F. Smith



*Captain Edward F. Smith
Atlanta, Ga.*

Safety shutter in window of cockpit shuts off vision of student, but not instructor



Soldiers Ride Seasick Machine to Help in Search for Cure

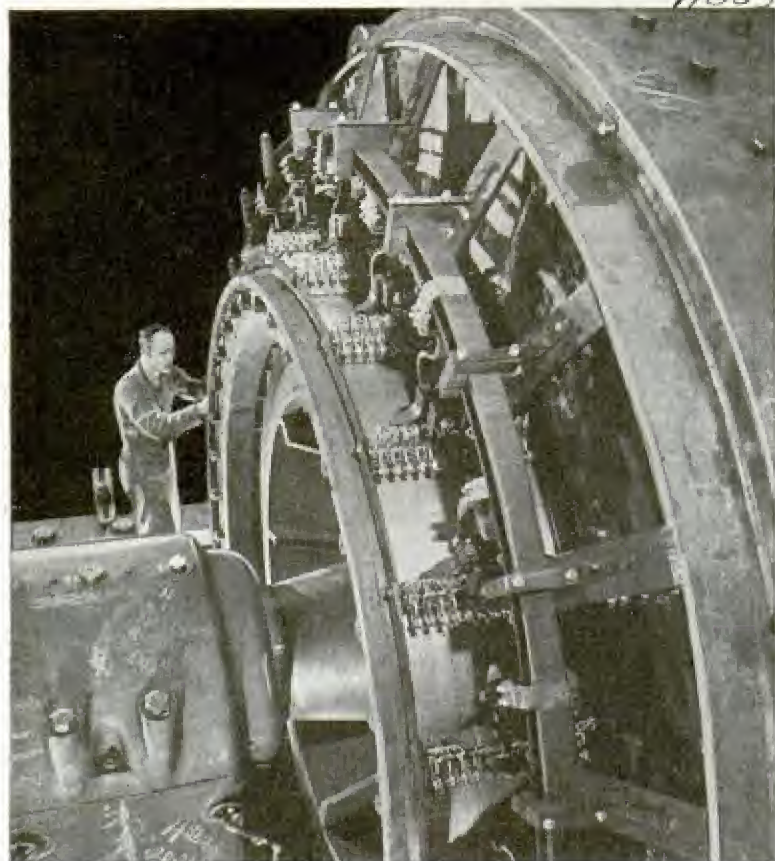


At the turn of a switch, these machines pitch and roll like boat at sea

"Martyrs" to science are the soldiers at an eastern camp, who volunteered to become seasick (on land) by riding a machine that reproduces the pitch, roll and yaw of a vessel on the ocean. Though many developed all the symptoms of mal-de-mer, they did it in a good cause, for out of the experiments the Army has developed anti-seasickness capsules. These "motion-sickness capsules" are given to amphibious troops an hour and a half before they embark.

77556

500,000-Pound Motor Reverses Itself In Just a Second and a Half



In reversing giant rotor, nearly 900,000 pounds of energy are released

One of the largest direct current motors ever built, weighing 500,000 pounds, is destined to drive a blooming mill to produce wartime steel. By means of a special control, the motor, product of the Allis-Chalmers Manufacturing Co., is capable of reversing itself in less than a second and a half. In reversing the 190,000-pound rotor, nearly 900,000 foot pounds of energy are released and then reabsorbed from the flywheel on the supporting motor-generator set. At peak, the motor can produce 19,000 horsepower, and in normal operation, 7,000 horsepower.

Resin Impregnates Cement To Halt Winter Scaling

Concrete highways and runways at airports tend to develop surface scale, caused by freezing, thawing, and the application of salt to remove ice. To halt these unfavorable reactions to winter weathering, Hercules Powder Co. has developed a pine wood resin which,

*Hercules Powder Co.
Wilmington, Del.*

when added to sacks of cement, increases resistance to such scaling. Surface scale, affecting the top quarter-inch of a concrete road, has always presented an engineering problem, but this has been magnified in recent years because the use of chemical compounds, usually chlorides, to remove ice has quickened the deterioration of road surfaces.

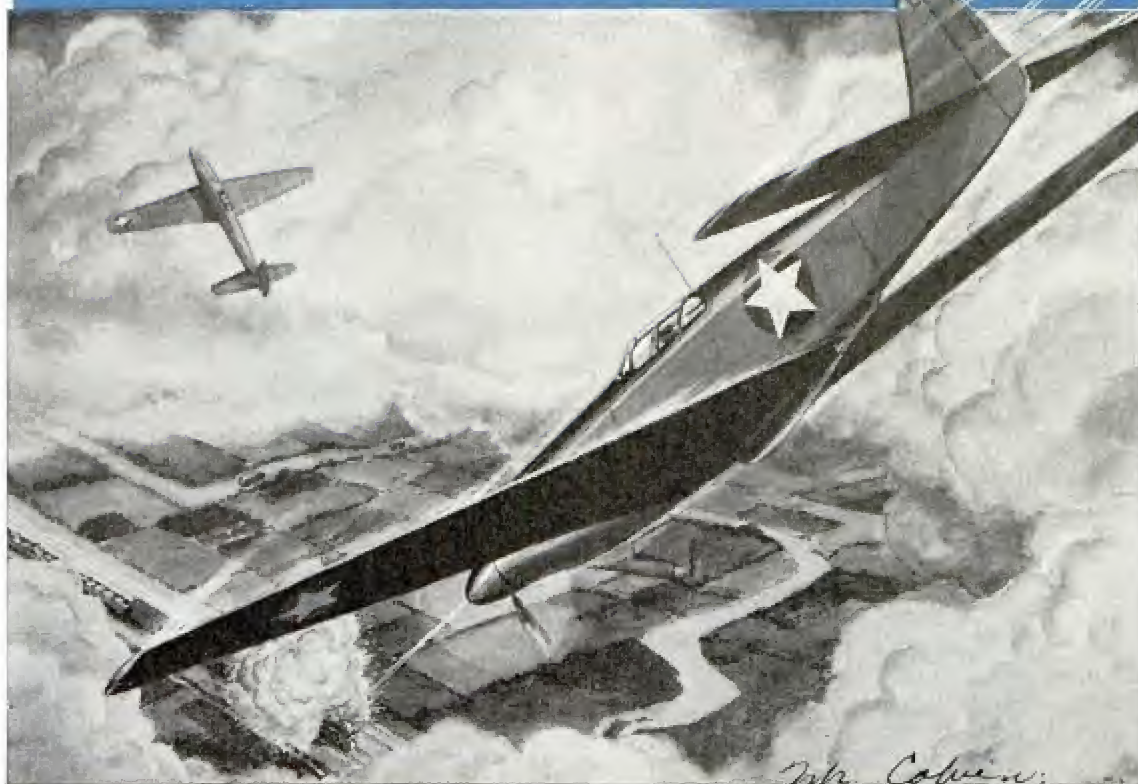
Armored Jackets Protect Fliers From Flak

As in medieval times, when "must" equipment for a warrior included a suit of mail, Uncle Sam's modern warriors of the skies are being equipped with body armor as a protection against bursts from antiaircraft guns. Such missiles cause a majority of wounds. The thin steel plates, which weigh about 20 pounds are slipped into pockets of a new sleeveless jacket that resembles a baseball catcher's chest protector. They protect the crewman front and back from neck to hips.



Gunner's sleeveless jacket is "lined" with thin steel plates

WILD HORSES of the SKY



P-51 Mustang, called the "outstanding fighter of 1943" dives to destroy an enemy locomotive

FOR the debut of a plane that was to win acclaim as the "world's outstanding fighter of 1943," the first appearance of a North American P-51, or "Mustang," over continental Europe was what its R.A.F. pilot might have called a "black," or a "floperoo."

There he was, zooming almost over the heads of the Hun batteries, in one of the hottest planes to come off a Yankee drafting board; wagging insults with his wings above enemy fighter fields—and nothing happened. The Nazis didn't even look twice.

The R.A.F. pilot got mad. He dived and cut loose with his .50-calibers on an exposed German ground position. There was a fateful pause—and the whole area erupted with anti-aircraft fire. The Mustang took its pilot safely back to Britain, but

the flier was still confused—until British anti-aircraft batteries began firing at Mustangs, too.

Then the puzzle was solved. The Mustang, new to both sides, looked to both like the standard Nazi fighter, the Messerschmitt 109. But it wasn't long until both belligerents recognized it for what it really



Fuselage of Mustang lowered into place on its famous laminar flow wing, one secret of speed



was, a lethal, hard-hitting pack of streamlined power.

British and American pilots, quoted by Maj. Thomas Hitchcock, United States Assistant Attache for Air in London, were responsible for the prediction that the Mustang would be the "world's outstanding fighter of 1943." Capt. Eddie Rickenbacker, hero of two wars, added his acclaim of Mustangs in these words:

"In my travels throughout the hell holes of the world, and my associations with the boys that are flying and maintaining them, I find that it is the outstanding fighter plane anywhere in the world. I saw comparative tests with the German Focke-Wulf, their latest fighter type, and frankly the Mustang outperformed it."

Such tribute from the men whose lives depend upon a plane's performance is gratifying, but no surprise, to the men of North American Aviation who designed this wild horse with wings.

For even though they built the craft, from design to prototype, in 100 days; even though they were working under the additional pressure of Hitler's advance through the Low Countries and France; even though they pioneered new structural designs



Built, from design to prototype, in just 100 days, the Mustang was meant to incorporate improvements suggested by first months of war. Low-level attack (above) and destruction of enemy planes (below) are its specialties



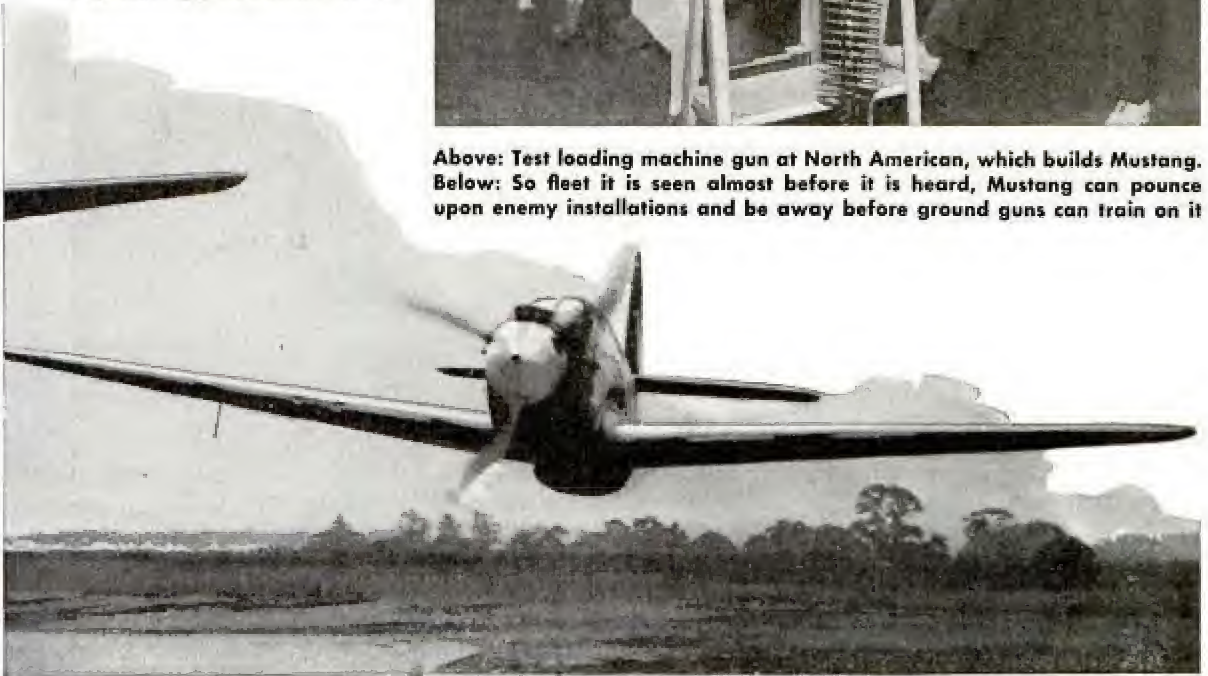
*Geraldine Mellon
Inglewood, Calif.*

that had never before been tried, and even though they feared at times their brainchild would be a failure, they built quality into every sleek line of this needle-nosed, power-packed speedster.

It was in the spring of 1940, when the Nazis were feinting with whole divisions on the western front, like a boxer drawing his opponent off bal-



Above: Test loading machine gun at North American, which builds Mustang.
Below: So fleet it is seen almost before it is heard, Mustang can pounce upon enemy installations and be away before ground guns can train on it

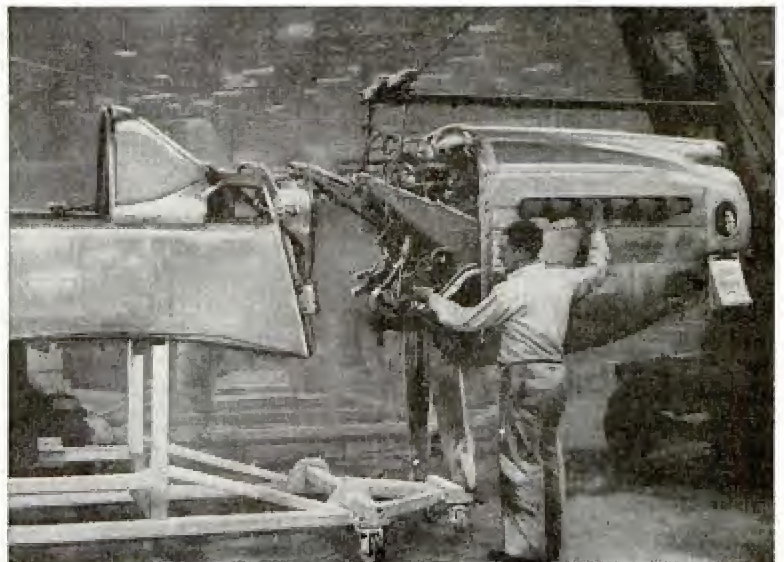


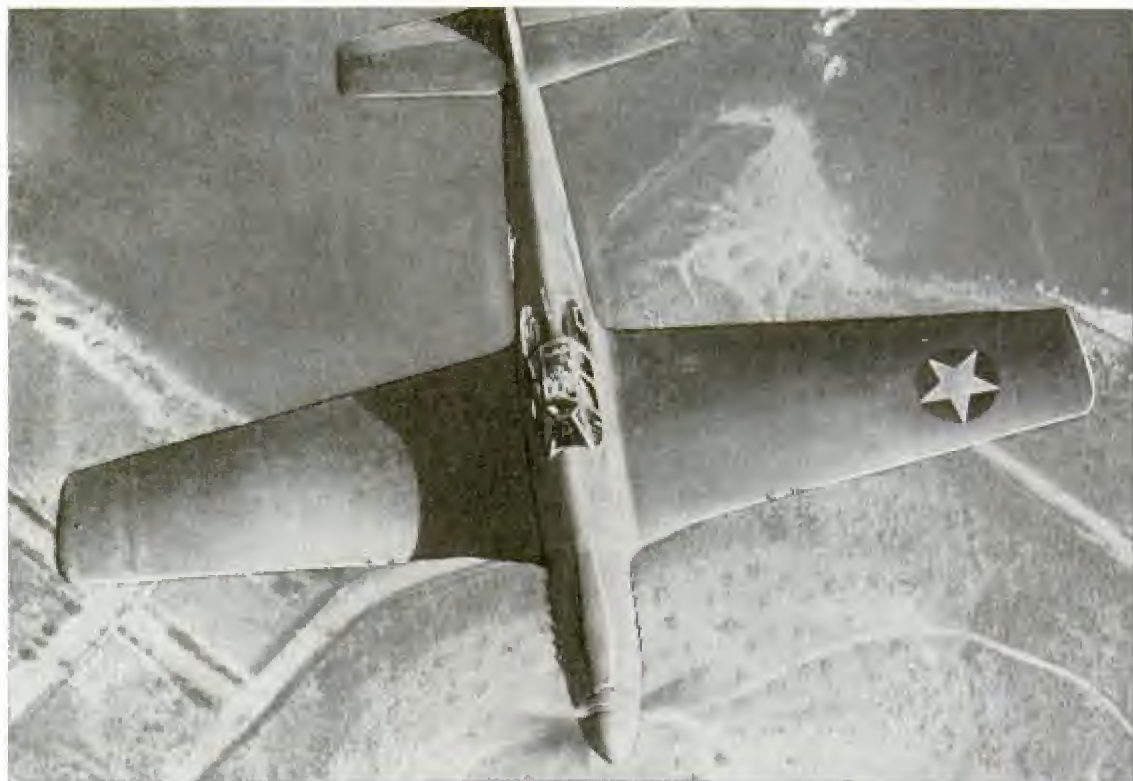
ance, that the British Purchasing Commission asked North American to produce a type of fighter then already in production elsewhere.

That model didn't fit well into the company's methods of simplified quantity production, so J. H. "Dutch" Kindelberger, president of the company, suggested that instead North American design and build a totally new type, incorporating all the lessons learned in the first six months of the war.

The British gave the company a list of requirements that the new fighter must meet, and assigned it just 120 days to

Fuselage of the Mustang is the smallest cross-section area ever placed behind an Allison engine, and so gave many headaches to designers who had to find space for its furnishings. Below, installing Allison motor





Sleek, needle-nosed and deadly, Mustangs have won their spurs as fighters and dive-bombers, designated A-36

complete the design and the prototype airplane. In spite of near-tragic difficulties, that schedule was surpassed; actually, the time was 100 days.

In those 14 weeks, North American's offices must have resembled organized chaos in a madhouse. In all, more than 2,800 original drawings had to be made. These were divided among specialized engineering groups—power plant, electrical, hydraulics, landing gear, armament, aerodynamics, radio and instruments, for example.

The instant any data could be released it was sent to the experimental shop, to be incorporated in the full-sized wooden "mockup" or replica of the ship; to the wind tunnel group that was carving a \$20,000 quarter-size model out of laminated mahogany; to the loftsmen laying out the full-scale drawings from which templates, or patterns, were made, and to the machine shop, sheet metal department and other factory units aiding the experimental shop in building the first Mustang.

Haste, but not waste motion, marked the growing pains of the "NA-73," as it was designated in the factory. A casting that should have taken three weeks was peeled out of the mold in two days. When it was found that a conventional tail shock strut couldn't be delivered in time, North American engineers designed a new and simplified one that has been used ever since. To determine the actual external lines of the

new plane, two engineers devised, in effect, a method of determining by mathematical tables the best possible streamlining between two points.

The Mustang's fuselage, smallest cross-section area ever placed behind an Allison engine, created so many problems in spacing furnishings, controls and instruments that one engineer remarked: "It was like taking the insides out of a bomber and trying to pack them into a fighter."

Even the now famous "laminar flow" wing (laminar flow meaning parallel or undisturbed flow of layers of air) caused its moments of suspense. This type of airfoil had never before been used, though research on it had been performed by the National Advisory Committee for Aeronautics. Their engineers had concluded that it was possible to design a wing that would reduce the drag as much as 50 percent below the drag of a normal, conventional wing.

In spite of the time limit, North American engineers won permission to test the laminar flow theory on the new Mustang, with the stipulation that if they failed a conventional wing would be designed and built within 30 days.

Because the Mustang was being designed for diving velocities approaching the speed of sound, it was imperative that the new wing have high lift and low drag. Engineers knew that shock waves greater than

any theretofore encountered would be built up at such extreme speeds, with destructive results if the wing were imperfect.

First wind-tunnel tests of the new wing indicated failure. The drag was the lowest on record, but silk tufts glued to the wing surfaces fluttered in danger signals—the stalling characteristics were bad. The wing was revised and a new model built in a week. Again, seeming failure.

But now the engineers suspected the model was too large for that tunnel, so they loaded their wing into an airliner and flew it to a larger wind tunnel. There it passed all tests in short order. There were sighs of relief mixed with shouts of jubilation.

Always operating under the pressure of the British deadline—pressure that increased as the Nazis pressed on to the very Channel that was Britain's last bulwark—the North American engineers met and conquered two more problems by "guess and correction."

The carburetor air intake wasn't right; at high speeds the engine simply cut out, and at other speeds there developed a peculiar pulsating effect. Having encountered similar trouble in the radiator scoop the engineers simply lengthened the carburetor air scoop until the intake was just aft the propeller, the longer duct apparently picking up "clean" air before it had set up any pulsations.

The aerial mast had its bugs, too. At high speeds it would simply snap off. It was determined that the mast set up a sidewise lift, almost as though it were a vertical wing. This lift caused the mast to vibrate until it flew away. A flattened steel tube mast worked, and cost the loss of only one-half a mile an hour in speed.

Any resemblance of the Mustang, ready for its motor in just 100 days, to the Messerschmitt 109 was only incidental. With the laminar flow wing, the squared wing tips and tail surfaces that make it resemble the German craft gave the most efficient performance.

That wing is no mere, cloistered darling of the laboratory, either. One R.A.F. pilot officer proved that when, strafing the Nazis in northern France at "zero feet," a favorite stunt with Mustangs, he clipped off half a wing on a cement telegraph pole. Without flaps, he landed without injury, chiefly by skidding in on the plane's nose.

A Canadian pilot, flying low-altitude cover for the Commandos in the Dieppe raid, reported to his base:

"Here I come. Get ready. No landing gear, no flaps, no nothing." He came in with only half his landing gear down, balanced the machine briefly on that wheel until it slowed, then nosed it over. He came out

(Continued to page 154)

NOVEMBER, 1943

*Mid-State Engineering Co.
2429 N. Michigan
Chicago, Ill.*

Saw Fits on Electric Drill To Cut Metal or Plywood

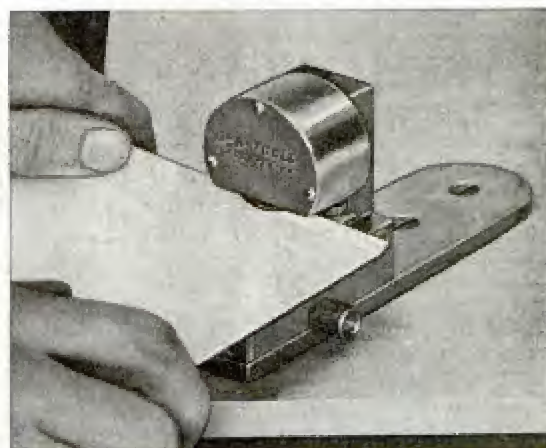


This "drill saw" can be used on either metal or wood

Stainless steel, monel metal, or plywood can be slotted or notched with a new attachment for an electric drill. The unit, which uses broken hack saw blades, serves as either saw or file. It will cut directly into wood without first drilling a hole. Blades from one-fourth to three-fourths of an inch in width can be used with any size teeth, depending on the material to be sawed. For filing, the saw blade holder is removed and a file holder inserted.

Hand-Operated Metal Crimper Mounts on Bench or in Vise

With a compact crimper weighing only four and one-half pounds, metal of varying thickness may be crimped by hand. In addition, the tool is adjustable to the width of the crimp desired. For permanent installation, the crimper may be mounted to a bench. It also may be used in a vise.



Tool is easily adjusted to width of crimp desired

*C-B Tools
Lancaster, Pa.*

65

KID STUFF for GROWN-UPS



On a model yacht basin at Franklin Institute a radio-controlled ship maneuvers as operator dials transmitter

Mr. Scout
THERE are no suppressed desires at the Franklin Institute in Philadelphia. Inhibitions are checked at the door. Men who are on their dignity the rest of the week break down into boys again and pump the handles of a railway handcar, play in scientific sand piles and crawl behind the stick of an airplane.

Here in one room is a press from Benjamin Franklin's printing shop, in another the largest technical library in the United

States, and here the beginnings of the steam engine. But this is no museum of dead things. The place is alive.

It is alive with boyhood dreams come true. Small boys and business men clamber over a modern steam locomotive and scramble up the ladder into the cab to grasp the throttle that drives it along a 16-foot section of track, and they discover that the uniformed attendant is getting as big a kick out of it as they are. You become an amateur scientist, yourself, as

you go about pushing buttons that start chemicals reacting in test tubes. Everything works; in fact about the only things that are not laid bare to expose their operating parts are the brains of the Institute scientists, many of whom are working behind locked doors just now on war research projects unknown even to their close associates. It is no surprise to find the Franklin Institute performing a service for the government. From its beginnings 119 years ago the Institute has been perpetually "on assignment" for city, state or nation.



The Automaton, which can write three verses and draw four pictures, baffles a young visitor

Before it was a museum or a planetarium or a physical research foundation, the Franklin Institute was a society "for the promotion of the mechanic arts"; in short, a school. Philadelphia in 1824 had no high school, and Samuel Vaughan Merrick, aged 22, had a job and needed mechanical training for it. Seeing the need, he enlisted influential citizens and together they founded the Institute, whose first business was to establish popular lectures, a library and exhibits, and promote inventions. Almost immediately its Journal was founded, one of America's first scientific publications, and when the U. S. Patent Office records were lost by fire the Journal files became the sole source of information on early patents. In 1830 the Institute made a study of steam boiler explosions for the government. Monthly weather reports were begun in 1831, and today the Institute has as complete a weather reporting service as any government bureau—plus a living exhibit of meteorological instruments. You can see the stars by daylight or view the spots on the sun through refracting and reflecting telescopes on the roof. And if an occasional group of visitors is found



Spinning faster on rotating seat as she pulls weights in with her arms, this girl is demonstrating the law of conservation of angular momentum

spinning the wind vane for a lively game of roulette, it is only a passing annoyance to the scientists.

Standardization of nut and screw threads was first proposed by a president of Franklin Institute in 1864. Its staff introduced the asbestos curtain to prevent theater fires, investigated highway pavements, studied the smoke nuisance as long ago as 1887, examined water pollution, conducted navigation and radio schools for the army

Sun Oil Company's working model shows refining of gasoline, kerosene, naphtha and oils from petroleum





Visitors watch a visitor demonstrate operation of telephone switchboard

in World War I and is currently helping to train Navy navigators and meteorologists, to whom the Planetarium is both school and playground.

Lecturers on the stars love to listen for the gasp of visitors as they throw the glowing image of the cross on the dark horizon of the Fels Planetarium during an Easter lecture, or send the planets swirling backward through time to where they stood over Bethlehem on the first Christmas.

Easily the most popular item on the museum bill of fare is the big Baldwin locomotive which came to rest at the Institute after a 100,000-mile tour of American railroads, and almost didn't get in.

Engineers had carefully gone over the blueprints of the 100-foot iron horse, standard railway bridges were built in the basement to support its weight—350 tons in working order—and a hole was knocked in the wall to admit the giant. By the blueprints, they figured No. 60000 could roll into the room with eight inches of head room. But when she got her nose in the opening the engineers let go a "hold everything!" The stack was all but scraping the ceiling. Where were those eight inches of leeway? It turned out that the blueprint measurements indicated height when loaded.

Without coal and water, the locomotive stood about seven inches taller. No. 60000 got in, but with only an inch to spare.

Contrasting with this railway goliath is one of the tiniest engines ever built, a half-ounce steam engine constructed in 1849 by a 16 year old boy from two gold and silver teaspoons. It works, too—its $\frac{1}{16}$ -inch cylinder and $\frac{3}{16}$ -inch stroke capable of delivering 3,000 revolutions per minute.

A solution to your gasoline rationing problems is seen in the "septet"—a bicycle built for seven. This 1896 model is part of a historical exhibit of bicycles, appropriately a door-opener to the aviation section, for most of the pioneer airplane builders grew out of the bicycle trade. The novice can try his flying ability in a Link trainer, study the effects of streamlining and airfoils in a pushbutton wind tunnel, and inspect such famed relics as Amelia Earhart's transatlantic monoplane, the first American autogiro, and the Wright Brothers' 13th airplane, rebuilt and flown by two boys in 1934 and the only Wright plane capable of flight today.

In the marine hall an attendant will proudly dial a shortwave transmitter controlling a model yacht cruising in its basin,

Wright Brothers' 13th plane, first flown in 1912, is the only Wright plane which is still capable of flight. It was rebuilt and flown again in 1934

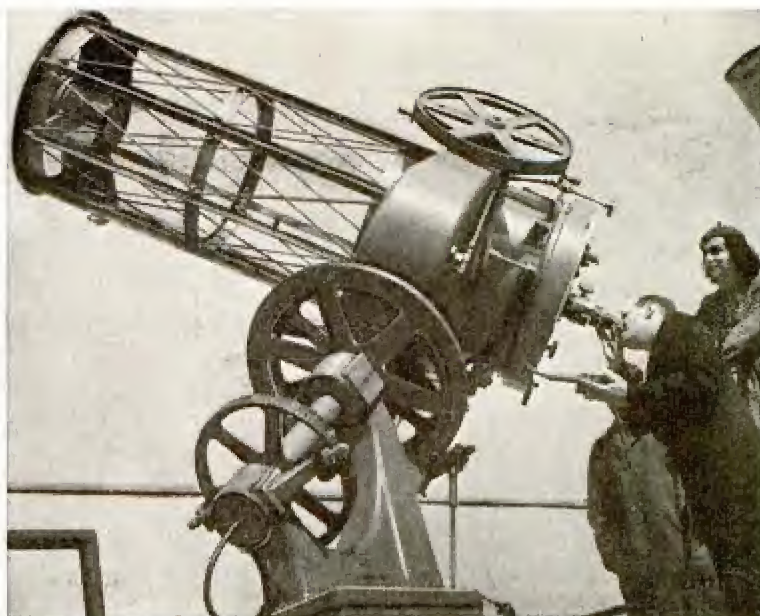


You can take a look at today's sunspots through this telescope on the Franklin Institute roof

and you can get a land-lubber's thrill by turning the wheel and engine-room controls on a fully equipped ship's bridge. Incidentally the Institute is a stickler for accuracy if iconoclastic, and it presents side by side mechanical models of Fulton's "Clermont" of 1806, popularly regarded as the first steamship, and the "John Fitch" of 1786, actually the first steamer in American waters, which plied the Delaware river at Philadelphia at eight miles an hour and logged 1,000 miles.

If you are a camera fan you can bring your own little black box and shoot pictures in a studio provided with professional lighting, and there is a display of matching photographs taken by a \$320 camera and a

19-cent camera which indicates that human skill has as much to do with the result as expensive equipment. You can also see the first successful attempt at motion pictures—a revolving sequence of stereoscopic



Men play engineer at the throttle of this 350-ton locomotive, running on a 16-foot track in museum





If you have aerial ambitions, try banking, climbing, turning and diving this captive trainer

it will after you have watched a sand-filled pendulum lay patterns as it swings. A bimetallic thermostat makes sense as you blow in response to the sign: "How hot is your breath?" Physics lessons come easy as you play tunes on glass tubes enclosing gas flames, send music over light beams and spin dizzily in a chair demonstrating the law of conservation of angular momentum.

The Institute likes to be practical. Some time ago the practicality of televi-

sion was given realistic demonstration by putting "on the air" the principals in a kidnapping case then under investigation.

Sometimes the scientists become over-demonstrative in their desire for realism, as in the case of the radio program that backfired. In the chemical room one push-button experiment demonstrates the electrolysis of water. Electric current separates a quantity of H_2O into its hydrogen and oxygen components, and for a startling climax the hydrogen, captured in a small glass cell is exploded by an electric spark with a sharp bang. The effect is not calming to the unsuspecting guest accustomed to mummy museums.

Typesetting and printing of some of the Institute's publications are performed as a "working" exhibit, and some of the very paper used is manufactured from pulp in a miniature Fourdrinier paper-making machine, rolling five feet of paper per minute.

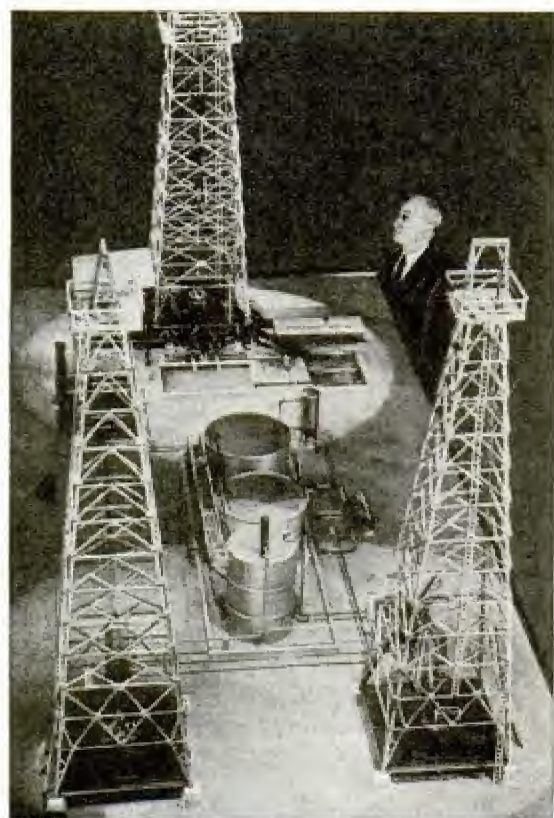
If the composition of simple periodic motions at right angles means nothing to you,

They put the experiment on the air for radio listeners one day. To be sure the hydrogen would be ready for its cue, they started the electrolysis a little early. When the lecturer pushed the button for the spark, there were nine minutes' worth of hydrogen instead of the usual two-minute supply. The resulting blast jolted the studio controls and knocked the program right off the air. They were back in a few seconds, but plenty of anxious inquiries came in on the studio telephone.

The beautiful memorial to Benjamin Franklin may itself be sufficient to hold your interest. You may want only to watch a half-million-volt surge generator split a block of wood, or record your voice on a magnetic steel wire and hear it talk back.

But the chances are fairly certain that sooner or later you will succumb to that alluring sign above the red fire box in the communications hall: "Come and ring a fire alarm." Even great scientists are sometimes small boys.

Drills and pumps of a model oil field reach down into a cutaway section of earth



Drills and pumps of a model oil field reach down into a cutaway section of earth

Ampro Corporation
28 34-51 N. Western Ave.
Chicago, Ill. *N 512*

Shadow Enemy Teaches Gunner Combat Firing



To train airplane gunner in battle realism, pictured "enemy" goes through all the maneuvers of air warfare

Attacking enemy planes don't stand still and give aerial gunners a set-up target like those they are accustomed to riddling in practice. One Navy radioman and gunner realized this, with a sinking feeling in the pit of his stomach, when his plane sustained its first attack. The enemy interceptors were looping, diving, barrel-rolling; they moved in and darted away, and his own plane was maneuvering as violently. There was no time for the leisurely marksmanship of the target range. His own reaction, and that of other gunners, pointed up the need for training in the kind of target-shooting one needs for actual combat—practice in split-second firing at an enemy that in the next second may be out of range. The Navy's response is a

gunnery trainer developed by Lt. Comdr. D. L. Hibbard of the Special Devices Section of the Navy's Bureau of Aeronautics. It provides machine gun practice under conditions closely resembling actual battle. Against a silver screen is projected the moving figure of an enemy plane, that goes through all the contortions of attack and evasion that a gunner may expect when he is in the cockpit over an enemy base. With the moving image is heard realistic sound of airplane motors. The gunner blasts away at the dipping, rising, swerving images on the screen to learn the technique that will make his gun deadly when the chips are down. Ampro projectors are used in the equipment, which is made for the Navy by the Jam Handy Organization.

Flanged Holes Punched With Press and Two-Part Tool *N 427*

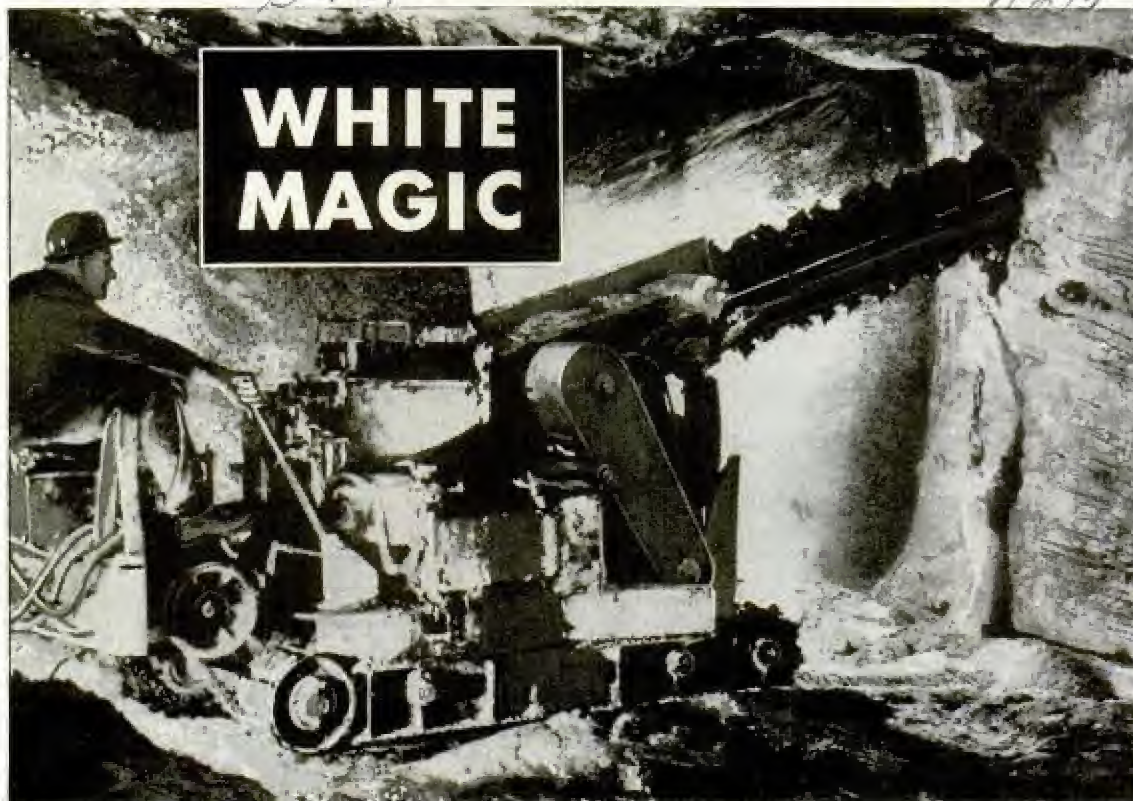
Flanged holes may be cut in metal, and the edges of the holes straightened to their original plane, by use of a punch that operates in conjunction with an arbor press. A small hole is drilled into the metal to permit insertion of a guide pin. By putting the halves of the punch together and clamping them in the arbor press, a pull of the handle cleanly cuts the hole of the diameter desired. Holes of five sizes from 1 to 3 inches in diameter, may be cut with the device.



Tool cuts flanged holes in metal, straightens edges

Write to the firms listed in the Where-to-Buy-It index, page 4A, to learn more about products described in this magazine. Say You Saw It in Popular Mechanics.

WHITE MAGIC



Side-shearing—cutting a vertical slot from top to bottom of a salt vein before blasting with explosive

MOST people regard salt as a very tasty condiment for touching up the end of a stalk of celery. It is. But that doesn't explain what happens to the 20 billion pounds of salt produced in this country every year.

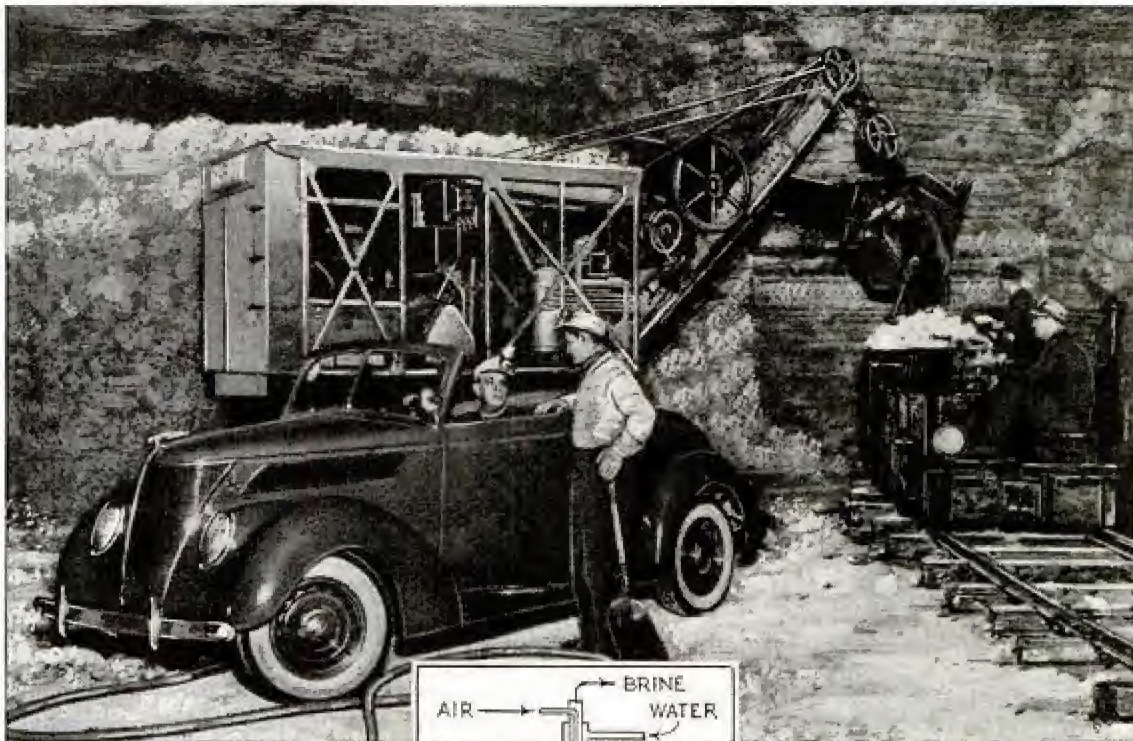
Without salt your body chemistry would cease operations, a fact which probably stems from the time when your remote ancestors wore furs and inhabited the briny deep, and which explains the wars fought around the saline Dead Sea from the dawn of history. Roman soldiers collected part of their pay in salt, whence cometh our word "salary," and Indians who followed animal trails to salt licks termed it "white magic."

If you ate your 150-pounds per capita share of our salt production last year, however, you are undoubtedly pickled and this article is beyond your interest. Assuming you didn't, you are entitled to an explanation of where your pile of salt went.

Power shovel loads "ore" cars on underground railway at Retsof Mine of International Salt Company, Inc., at Retsof, N. Y.

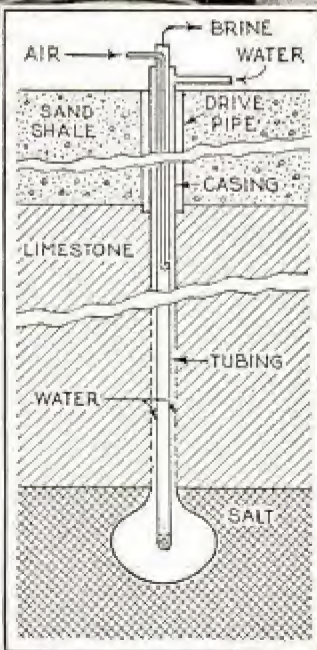
Some of it whitened the collar of your shirt. Some tanned the leather of your shoes. Some bleached the cotton liners for smokeless powder, and some was the basis of high explosives and of chlorine gas, or of the cyanides used as fumigants and insecticides. You recognized it on pretzels and in salt mackerel and ham, but salt was also present incognito in the fast colors of your sister's print dress, in the white paper of this magazine, in soap and window panes and sodium vapor lamps.





Our chemical industries have a far greater appetite for common salt than we, whose lives depend upon it. Mineral salt ranks fifth, brine seventh among the most important chemicals. As the basis for all of the sodium compounds and most of the chlorine compounds, it enters directly or indirectly into the manufacture of a majority of the everyday commodities we use and has earned the designation of a heavy chemical essential to national defense.

If it will relieve you of worry, there is believed to be enough salt in Michigan to supply mankind's needs for 200 million years. Michigan, New York, Ohio and Louisiana are our chief producers. Eleven hundred feet beneath the streets of Detroit is a 200-acre salt mine whose office is built of rock salt. The International Salt Company's mine at Retsof, N. Y., covers 1,000 acres and a dozen electric locomotives haul hundreds of "ore" cars through 120 miles of subterranean passageways. The hemisphere's oldest salt mine at Avery Island, La., developed by the blockaded Confeder-



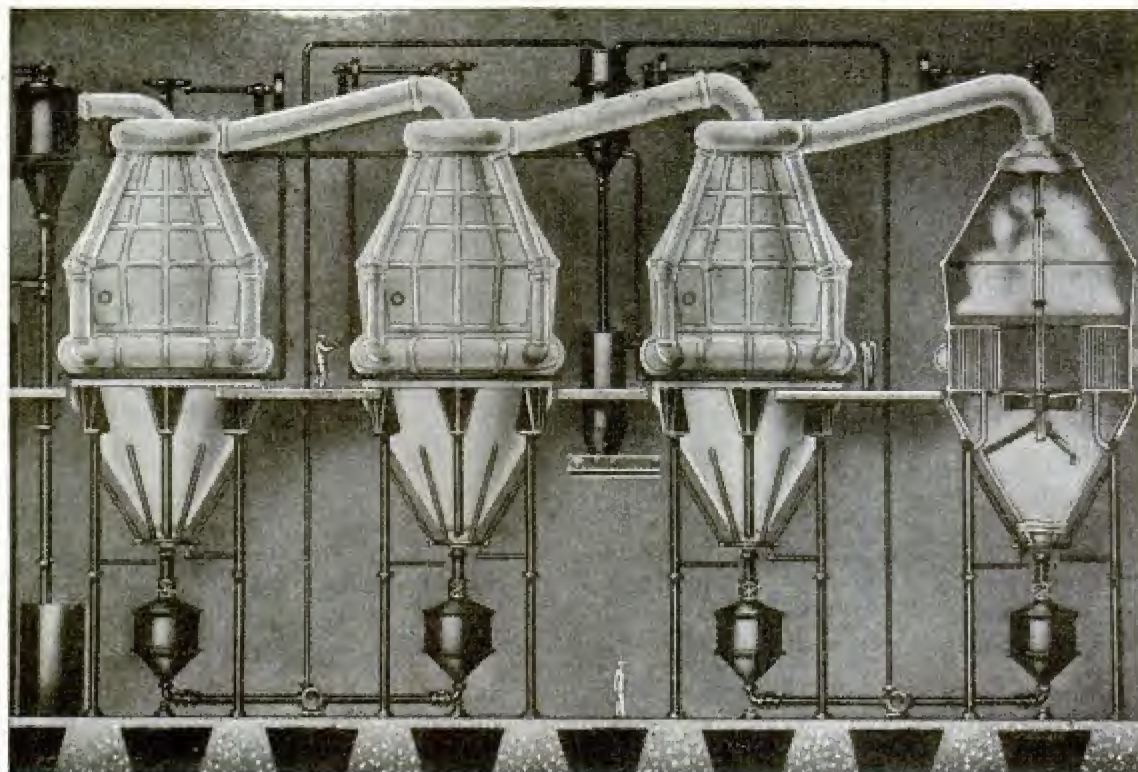
International Salt Co. photo

Thousands of tons of rock salt are produced yearly in this mine under the city of Detroit. The workings are large enough to permit the mine foreman to drive around in his car

Diagram shows how water driven into salt well dissolves rock salt and forces it up central tube as brine

Sodium vapor lamps—the sodium being derived from common salt—are said to consume only half as many watts of power per lumen of light output as incandescent lamps





Vacuum-evaporated salt is produced in these "vacuum pans," from which the salt is periodically removed

acy during the Civil War, is today a vast cavern whose crystalline roof is supported by pillars of salt more than 60 feet high, dwarfing the power shovels that bite into 25,000-ton mountains of rock salt blasted from the walls by powder men. The Avery Island vein is a gigantic dome of salt, mushroom-shaped, formed geological ages ago by pressure that forced a deep well of brine upward to within 12 feet of the earth's surface. Drills have explored the dome beyond the 2,200-foot depth without finding a bottom of the solid salt.

Salt is obtained by mining, by evaporating salt lakes and ocean water and surface beds, and by drilling wells, thrusting double tubes into them and pumping water down the outer tube to dissolve the rock salt and emerge from the inner pipe as brine, which is then evaporated.

The ultra-refined salt for your shaker is evaporated from brine in enormous vacuum pans which are, in effect, double boilers. As the crystals sink to the bottom they are removed periodically, pumped to filters to remove excess moisture, then to rotary driers where 350-degree heat sterilizes and dries the salt ready for packaging.

Eighty percent or more of our salt is needed by industry, and with American industry geared up for war the output of salt was stepped up by a quarter of a million tons last year. It has been estimated that every ton of magnesium produced requires

the use of five tons of salt. We are using a million tons of chlorine per year, and this calls for 1,750,000 tons of salt. The uses of chlorine for bleaching, for water purification, for poison gases are well known. Not so transparent are the facts that chlorine is essential in the making of synthetic rubber, of carbon tetrachloride for cleansing fluids and fire extinguishers, of lubricants, of degreasing solvents. One ton of chlorine is expended in the building of every tank, two tons go into the manufacture of every plane. And consider these paradoxes: salt is elemental in the manufacture of magnesium used in most incendiary bombs, and plain salt is one of the most effective agents for smothering the bomb; chlorine is an ingredient in such deadly war gases as phosgene, mustard and Lewisite and screening smokes, while the principal decontaminating agent used in fighting poison gas is chloride of lime, another derivative of salt.

It is electric power that divorces the partnership of salt (NaCl) into its constituents, sodium and chloride. Positive and negative electrodes are immersed in great tanks of brine, and the sodium ions gather at the negative electrode, the chlorine travels to the positive side and is piped off as gas. In the Castner electrolytic cell employed by the Mathieson Alkali Works, metallic sodium discharges into a pool of mercury which forms the cathode, and as

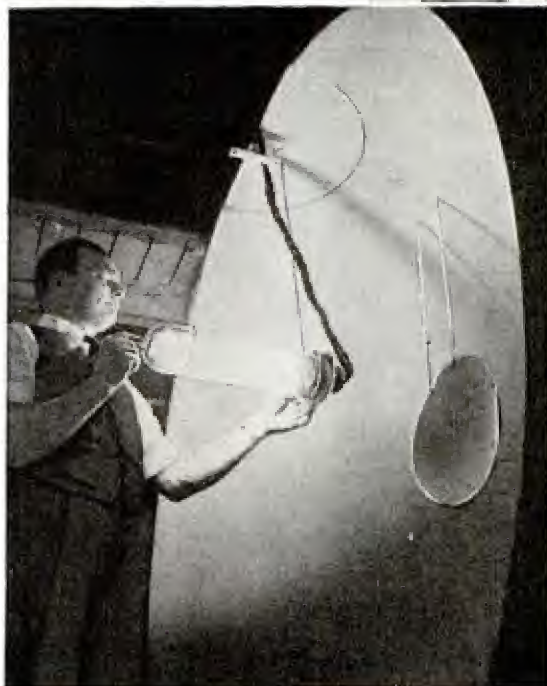
the cell rocks back and forth the silvery-white metal reacts with water to form caustic soda solution and hydrogen gas, which are continually withdrawn. It was only in 1909 that Mathieson began commercial production of liquid chlorine. Synthetic ammonia, too, is an outgrowth of the electrolysis of salt. Nitrogen separated from the air by compression and cooling is combined under pressure and with the aid of a catalyst with the pure hydrogen obtained from the electrolytic cell, and the result is pure ammonia gas. Dry Ice (frozen carbon dioxide), bicarbonate of soda, baking powder, soda ash used in glass manufacture, synthetic salt cake used in paper mills, and caustic soda (NaOH) are some of the major products of the breakdown of salt. Caustic soda finds its way into more industries than any other derivative—among them, foods, drugs, rayon manufacture, cleansers and disinfectants, aluminum, gasoline, explosives, soap and paints and machine tools.

Sodium is a capricious silvery metal that burns under water, weighs one-eighth as much as iron, is a good conductor of electricity and a versatile

Right, drilling holes for dynamite in a Louisiana salt cave. Below, a General Electric engineer tests a sodium vapor lamp



Firing a mortar shell filled with gas made from salt



servant of man. Easily alloyed, essential in making bronze and brass, it is used—like its partner, chlorine—in tetraethyl lead for antiknock gasoline; as sodium peroxide it is a bleaching agent, as sodium perborate a tooth powder, as sodium cyanide a fumigant and insecticide and the means of case-hardening automobile gears.

Salt and its byproducts have invaded many new fields in recent years. Caustic soda is highly important at the moment for recovering tin from used cans; it dissolves tin from the sheet steel, and the tin oxide precipitated can then be reduced and cast into pigs. Sodium vapor lamps, first applied to traffic lighting, now are used in examining metals for flaws. A pinch of sodium— $\frac{1}{80}$ ounce—is sealed in a tiny "bomb," placed in the vacuum bulb, and vaporizes when exploded by heat. The vapor, when activated by the electric arc,

(Continued to page 148)

Bicycle "Path" Inside Dam Serves for Maintenance



Inspector pauses on tunnel tour in Grand Coulee dam

Within the great masonry structure of Grand Coulee dam are miles of tunnels that lead to intricate machinery and thermostats. These tunnels are used by inspectors and maintenance men, many of whom travel by bicycle. They average about 12 miles a day. Because of the war, the tunnels are closed to the public, but postwar visitors will be allowed to tour the depths of "the biggest thing on earth."

Stop Nut for Plywood Airplanes Leaves Outer Surface Smooth



Approved by the Army Air Corps for use in the manufacture of plywood airplanes, a self-locking fastener anchors nuts securely and leaves the outside surface smooth. It is similar to the elastic stop nuts used on metal planes, but has a special basket that locks into the plywood and holds the nut securely. Four prongs at the

76

Elastic Stop Nut Corp. of America, Yonkers, N.Y., License, N.Y.

corner of the basket sink into the surface of the wood, and spring fingers at the top clasp the nut after it is seated. It can be used on plywood ranging in thickness from one-eighth inch up. The nut, which was developed by the Elastic Stop Nut Corporation of America, requires no special tools. Installed from one side of the work, it can be driven in with a hammer, forced in with a press, or drawn in with a bolt.

"Electric Eye" for Blind Worker Is Attached to Sewing Machine

Blind workers can safely operate a sewing machine with an electric eye attachment that stops the machine if their fingers approach dangerously near the needle. When the beam in front of the needle is broken, the photoelectric cell operates an amplifier which controls a relay disconnecting the driving motor. At the same time an electromagnetic brake is applied to the fly wheel. Buzzers also warn the blind worker when the thread runs out or breaks. It was developed by the American Foundation for the Blind.

Hot Metal Is Sprayed Like Paint To Patch Galvanized Unit

Galvanized metals that are burned by welding or otherwise marred can be patched by spraying with a molten alloy consisting mostly of lead. The special sprayer melts the alloy at 500 degrees Fahrenheit and sprays it on welds or worn parts like paint. The new coating saves regalvanizing an entire unit, adheres evenly despite the smoothness of the surface and forms a good paint base.



Spraying marred galvanized metal with molten alloy

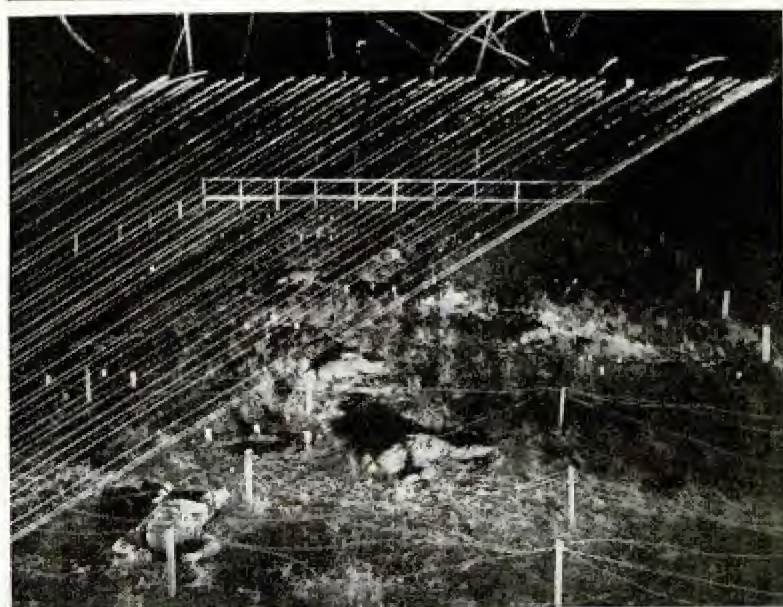
POPULAR MECHANICS

Alloy Sprayer Co. 2040 Park Avenue Bldg. Detroit, Mich.

71 460 Live Ammunition Gives Yanks Preview of Battle



Real death-dealing bombs, high explosive shells, grenades and mines are exploding on the soil of the United States—not invasion of our country, but rehearsal for invasion of enemy shores. Use of live ammunition has become an integral part of the training of men who are going into battle. It gives them a foretaste of war before they actually have to face it. How a man will behave in battle is often unpredictable; by simulating conditions beforehand, instructors can correct errors in behavior that might later be fatal. Men of a tank destroyer battalion above are crawling through wire toward their objective, as land mines explode around them. Timing of the explosions is, of course, carefully controlled, so as to avert injury to the men. Upper right, men in landing rehearsal dash ahead, while mammoth explosion showers dirt and stones down around their route



Under conditions such as are shown above, men rapidly learn to keep their heads down and to hug the earth. They are members of a tank destroyer unit, and are negotiating a barbed-wire course while real tracer bullets whistle over their heads. Left, successful landing is made by men in training despite the eruption of mud and water from explosions on the beach. Accident and injury in this type of training are rare, and men who have seen battle say training with live ammunition will undoubtedly save many lives at the front, for it teaches soldier in advance the tricks of self-protection

maneuvers: somewhere in Arkansas & Acker, Ala. by 81 Div. camp

MINE KILLERS *at* WORK



Two members of a mine disposal squad of the Royal Canadian Navy tow a big one filled with nitroglycerin toward shore. Its "horns," or exterior detonators, have been removed, but it is still dangerous to handle. Crews are composed of volunteers who risk their lives daily and get no extra pay. The photographs on these pages are the first to be made of this hazardous operation along American shores.



Photos courtesy of Canadian National Film Board

Above, preparing to hoist mine up cliff along coast which lacks a convenient beach for final operation in rendering harmless these perils to shipping



It takes nerves of steel to ride this lethal monster of the sea ashore. Pulleys are attached to lift it to rocky beach. Right, rolling mine gingerly into position for next operation. No onlookers are allowed in the vicinity



After the detonators are removed, the mine can be tapped with a hammer but the lieutenant in charge makes sure his men take no unnecessary risks in handling load of nitroglycerin powerful enough to blow a warship out of the water. Every man is alert, and sometimes the crews go 24 hours without sleep on assignments that are tough. One slip in handling the spheres of steel may mean death



Left, removing internal detonators and caps of TNT container. Then the surface of the explosive is roughed up before setting fire to it. The crew calls this operation "teasing" a mine



With a sharp instrument, lieutenant in charge (above) scratches surface of the explosive. It is set on fire from a safe distance and burns (left) furiously. Only when the last spark is out is the mine harmless. Sometimes mines are exploded instead of burned, depending on locale

*Watchmakers Optical Co.
Providence, R.I.*

Goggles Fit Over Glasses Giving Full Protection

N 482



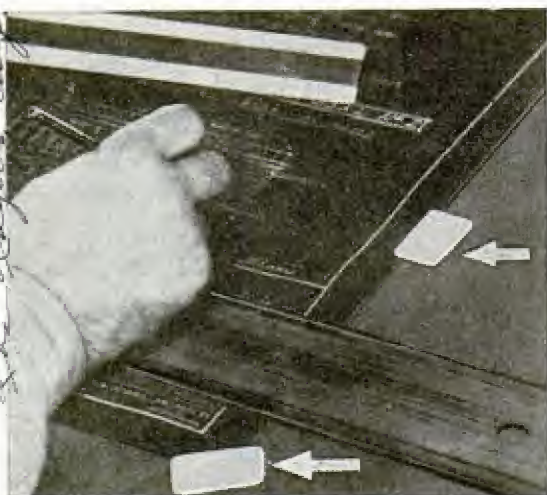
Plastic goggles have shatterproof Plexiglas lenses

With lenses made of the non-distorting and shatterproof Plexiglas used in the "greenhouses" of big bombers, an all-plastic goggle fits snugly over a worker's spectacles. The full frame which weighs only one and three-fourths ounces gives protection from sides, top and bottom. Snap-in filters are available to reduce glare in torch-welding or cutting.

"Dry" Stickers Hold Blueprints To Eliminate Thumb Tacks

N 308

Paper thin stickers that require no moistening are used to hold drawings and blueprints to drawing boards, thus eliminating



Stickers hold blueprint without leaving gummy mark

*A. W. Sherin, Director
Chemical Products Div.
C. I. du Pont, Del.*
bothersome thumb tacks that sometimes interfere with a draftsman's free movement of T-squares. The stickers are easily peeled off without tearing the drawings or leaving gummy marks. Because the adhesive does not come off, the stickers can be used many times.

Chemical Reactivates Antifreeze To Prevent Motor Corrosion

N 576

Last winter's antifreeze solution, saved over for this year's use, may be reconditioned by the addition of a chemical inhibitor. Saved-over antifreeze solutions in some instances lose their rust-inhibiting properties, and become acid after extended use. If they are replaced in an automobile cooling system without being treated again with an inhibitor, they may cause corrosion. A chemical inhibitor manufactured by the Du Pont Company may be added to any standard antifreeze solution, the makers say. It does not contribute to antifreeze properties, but merely neutralizes any acid formation and restores the lost rust inhibitor.

Iron Box Keeps Matches Safe In War Powder Plant

Whittaker



Box is opened by lifting the spring lid with finger

Safety matches are carried in a special cast iron box at the Hercules Powder Company's Badger Ordnance Works at Baraboo, Wis. The box has a spring lid attached to the handle. The matches are used in the powder plant by welders who light their torches under the watchful eyes of safety engineers.

¶To learn where to buy commercial products described in these pages, see the index.

*Shrunk Popular Mechanics Co.
Wilmingon, Del.*

*Army Addressing
4481, C. 3rd St.
Los Angeles, Calif.*

Jeeps and Pick-a-Back Seats Carry Wounded



Jeep-ambulances above carry four stretchers. Right, seat for wounded man leaves carrier's hands free

By use of highly mobile equipment, members of a motorized medical battalion are able to erect, equip, and put their various stations into action within an hour of arrival at an appointed sector of a battle line. When casualties are located, they are transported to medical clearing stations with the greatest dispatch, since speed in treatment saves lives. Of especial value is the famed jeep, which is fitted with well-sprung racks holding stretchers in position. These midget ambulances essay any terrain, and can transport four or more wounded men. Another method of transporting a casualty is the "Green carrier," or "pick-a-back seat." It is a framework slung from a bearer onto which the wounded man is strapped so he cannot slip to the ground, while the bearer's hands are free. Such motorized medical battalions can dismantle their equipment and be off to another battle sector in half an hour.



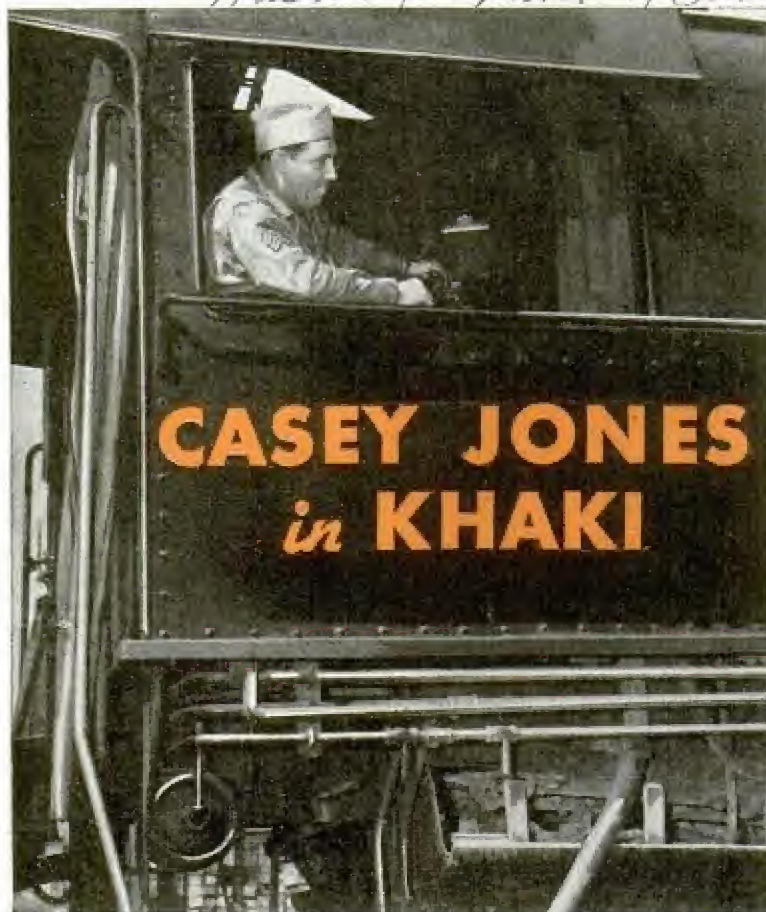
A. Levine
North Bergen, N.J.

Carl R. Wilsh, Lambertville, N.J.

Limiting the Length of Hairpins Saves 5,000 Tons of Steel

By limiting the length of women's hairpins and bobby pins to two inches, the United States was able to conserve 5,000 tons of steel in one year. This is one example of how curtailment of size and standardization of type saved raw materials and diverted them to war uses. The length of household matches was reduced $\frac{1}{16}$ and $\frac{1}{4}$ inch, and as a result 7,000,000 board feet of lumber were conserved. Re-

ducing the number of sizes of automobile batteries from 100 to 17 saved 16 million pounds of secondary lead, over 17 million pounds of primary lead, and over 1,250,000 pounds of secondary antimony. By reducing types and sizes of auto chains, 21,000 tons of carbon steel and smaller quantities of other metals were conserved. Making one cookstove model and curtailing use of metal saved 350,000 tons of iron and steel.



Sergeant-engineer (above) one day may be at the throttle of the first train into Berlin. He wears insignia of Transportation Corps of Army Service Forces, trained for railroading in war zones. Below, a uniformed welder



By James Colvin

EXCEPT for the background, it might have happened anywhere in the American Midwest—just another freight double-heading in on time.

The engineer was from Breckenridge, Minnesota. The fireman was from Muscatine, Iowa. The locomotives were Baldwins. Stamped on the steel of the freight cars might be seen the name of another familiar American manufacturer. But the incident marked far more than just a routine freight haul.

The place was Teheran, Iran—ancient Persia. The train crew all wore American Army uniforms, and the insignia of the Transportation Corps of the Army Service Forces. The freight had just steamed 650 miles from a port on the Persian Gulf, with supplies for Russia—made in America by Americans, landed at American-built docks from American-built ships. It marked the first delivery of a complete United States war train to bolster the fighting forces of the Soviet. From Teheran north, an all-Russian crew took over.

Soldiers don't just happen to learn to run railroads. Behind that incident were months of training, and often back-breaking work.

The engine crew and train crew, the signalmen, dispatchers, section hands—all the hierarchy of railroading necessary to take that all-American freight train from the Persian Gulf to the junction with the Russians—had a background of military railroading similar to the one the Southern Railway has helped to give to two whole railway operating battalions.

The American Civil

Soldiers learn every job in railroading, from dispatching to switching. A yard crew, riding engine



War established for all time that control over railroads and their running stock is essential to continued operations in a battle zone. Control of a rail line was a central point in one of the first big campaigns of that war, the one in 1861 that resulted in the adherence of West Virginia to the Union. And Lee abandoned Richmond after Grant cut his rail lines.

In this war, British-flown Mustangs and Mosquito bombers make almost daily sorties against trains carrying men and materials for Germany—and fliers say a blown-up locomotive makes a most satisfactory explosion, when the locomotive is the enemy's. American Flying Fortresses have given persistent attention to great railway centers of Western Europe.

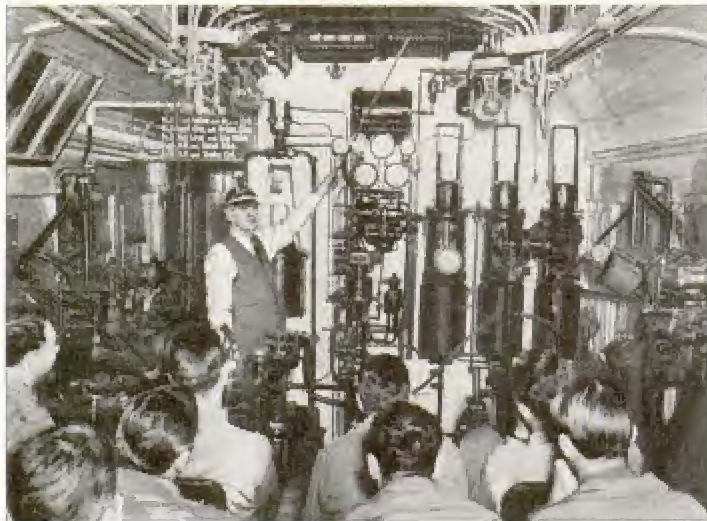
There are stories that Hitler never properly

Back on the caboose, conductor and switchman are learning to combine arts of railroading and of war





Sergeant at right (above) supervises two soldiers rerailing a box car—vital knowledge to men who will handle rail lines under fire



Above, a group of uniformed engineers receive instructions in the operation of air brakes. Below, a soldier section gang in training. Note uniform puttees, slouch hats, canteen on man at left
Photos courtesy Southern Railway



evaluated railroads; that he allowed Germany's to fall into disrepair while he was using his steel to forge a mailed fist threatening the civilized world. We think better of our rail lines; and now we have to think of the ones Hitler has, too—we may have to operate them one day.

Down on the New Orleans and Northeastern, part of the Southern Railway System, railroaders in khaki are an old story. It's there, on the route from Meridian, Miss., to New Orleans, that two battalions have learned what they will need to know to take over and operate entire divisions in some theater of operations.

Under the tutelage of men who have made railroading a career, these khaki-clad minions of the Iron Horse have studied everything from how to get whiskers (frost) off the rails and pick up orders on the fly to the proper way to lay track and dispatch trains. The goal was the training of self-contained units that could take over friendly or captured railway lines and keep the men and materiel moving to the front, the American way.

When the War Department asked the Southern to train the first of these battalions—the Transportation Corps' 727th Railway Operating Battalion—there was little past experience upon which the

Southern could draw, for no such unit had ever before been trained by a common carrier. But the Southern executives and workmen were as willing to teach as the soldiers were willing to learn.

Harry A. DeButts, vice-president of the Southern, wrote the men of the New Orleans and Northeastern:

"We have every reason to be proud that we are to have the privilege of helping our boys in uniform prepare for the vital task of operating some military railroad on which our fighting forces will be depending for ammunition, materials and supplies.

"We will make available our 'trained and experienced personnel' (this means you) to teach and demonstrate to these soldier railroaders the duties they will be called upon to perform when they operate a military railroad. This training will neither displace nor reduce your duties and responsibilities, nor affect your compensation."

Executives and men alike on the N.O.&N.E.said, in effect, "Okay!" Workers held a meeting and suspended certain union rules in order to help out. Beginning from scratch, executives proceeded on the assumption that a battalion operating a railroad in a war zone might have to use every sort of makeshift to keep 'em rolling, and, largely even without a suggestion from the army, set up equipment for the soldiers, side by side with the road's regular equipment.

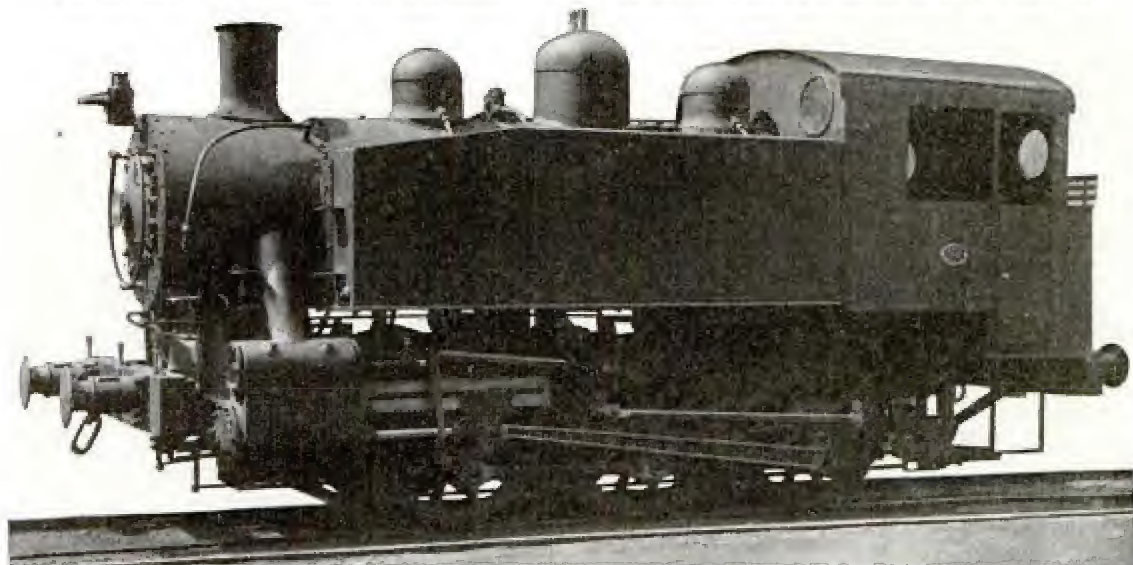


Trained to take his locomotive through, in spite of bombs or shells, is this engineer of a U. S. railway operating battalion

How the program suited the army is told in the words of Brig. Gen. Carl R. Gray, Jr., general manager of the United States Military Railway Service Transportation Corps, in a letter to the Southern:

"Never has there been in my knowledge of railroad service more cooperative, coordinated, unselfish and thoroughly competent help given anybody than the officers and men of the Southern Railway System

Side-tank type locomotive is a war baby, made in Pittsburgh by H. K. Porter Co., Inc., for use by the United Nations. It can haul equipment to battle zones, or work near docks or supply centers





Soldiers in Mississippi shops learn to change wheels of a tank car

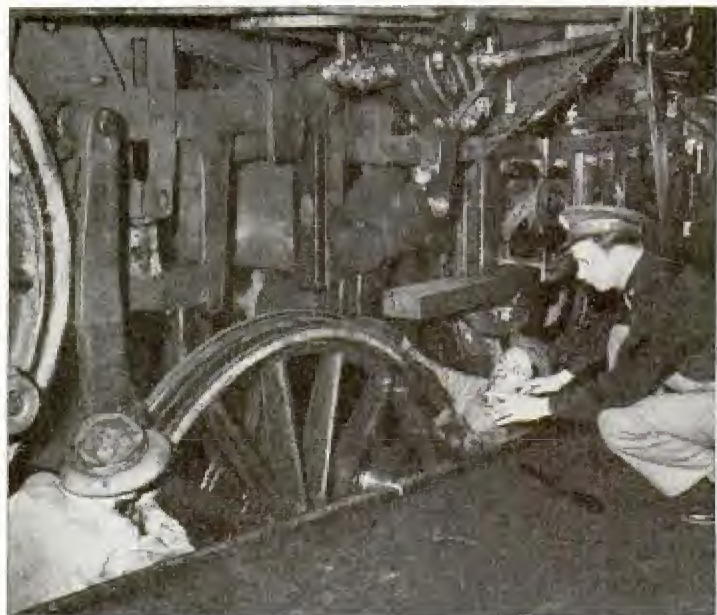
have given in the training of the 727th."

Even though the line was transformed into a laboratory for war, the N. O. & N. E.'s trains still had to go through. Service on the line from Meridian to New Orleans operated as usual. The only difference was that two men were present on each job at all times, one the Southern's and the other the army's.

As the soldiers became better acquainted with their new jobs, they gradually took over, but civilian employees stood watchfully by.

Since the soldiers would be railroading under handicaps, they were trained the hard way. At a war front, for instance,

Learning to be grooms of the Iron Horse are these soldier-mechanics



chances are a railroader wouldn't find the retreating enemy had left telephone and telegraph equipment intact, with wires still running into signal towers and dispatchers' offices. So to acquaint soldiers with makeshifts, the Southern built makeshifts.

Emphasis was on mobility. Cars were transformed for eating and sleeping. Assuming that roundhouses and shops in the war zone might be bombed out of existence, a box car was converted into a mobile repair shop adequate to handle ordinary running repairs, wherever they might be needed along the line. All its heavy machinery was powered by a 25-horsepower gasoline (or kerosene) engine, to make the Yanks independent

of fixed sources of power an enemy might also destroy.

At the battalion's Hattiesburg headquarters the Southern set up an office car for the commanding officer; two camp cars converted into offices and emergency sleeping quarters for other officers; two kitchen and mess cars and three others equipped with double-decked bunks for men. Dispatching, telegraph, telephone and light and water equipment were installed in the office cars.

On the far end of the division, swinging north from New Orleans in the rocking cupola of a caboose in which your partner would be a trainman-sergeant, you would see, as the cars began to grind over the long trestle across Lake Pontchartrain, a gang standing to one side to let the freight pass through. They would be soldiers, too—bridge gangs and operators billeted in one of the camp cars converted for army use.

Farther along you might pass soldiers of the section gang, men who work as section gangs have in all railroading history, except that these would be outfitted in army work clothes, with canvas puttees and slouch-brimmed army hats, with perhaps a canteen swung at the hip.

A soldier is at the throttle of your locomotive, and another is shoveling coal across the grates; at a stop for water a soldier walks along, watch-

Inch-Thick Kit for Aviators Holds Emergency Supplies



Snug fitting kit is worn under pilot's flying suit

If a Royal Canadian Air Force pilot is forced down in the wilderness or at sea, his chance of survival is increased with a new personal emergency kit. It is only an inch thick and is worn under his flying suit. The kit contains rations for three days, fishing tackle, first-aid kit, compass, clasp knife, a supply of matches in a waterproof container, a plastic whistle, and a signaling mirror.

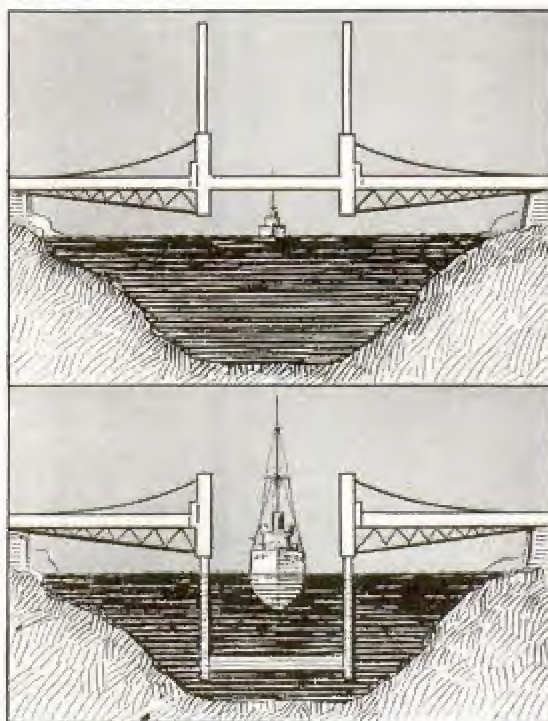
Shoes and Bedsprings of Nylon Predicted for Postwar Era

Consumers accustomed to thinking of nylon as the gossamer threads that make flattering hose might gape at the plans E. I. du Pont de Nemours & Co. have for utilizing the material after the war. Currently, most nylon is being used in parachute cloth, bomber tire cords and glider rope, in brush bristles and surgical sutures. But nylon plastic is also being used for secret military purposes. Nylon in this form is a thermoplastic, meaning that under heat and pressure it can be reshaped and reformed any number of times. But it has an extremely high softening point—450

degrees compared with the average of 160 degrees for other thermoplastics—and because of this approaches the nature of the other type of plastics, thermosetting materials. The latter cannot be remolded, once they are formed under heat and pressure, even though heat sufficient to char the material is applied. Nylon is also one of the lightest-weight plastics; it burns slowly, undergoes little or no deterioration with age, resists oil, grease, solvents, alkalis and weak acids and is readily machined. Bearings of nylon plastic were made before the war, and the company foresees its use to make these other products: Zippers, vacuum packages, handbags, luggage and shoes, industrial coil springs, rattan for furniture.

"Ducking Bridge" Lowers Span To Permit Ships to Pass

Faced with the continuing threat of monsoon gales, an Indian Army engineer charged with building a drawbridge in Iraq decided against erecting the tall towers that would support the raised roadway of an ordinary drawbridge. Instead, he designed a bridge that actually "ducks"—its span submerges beneath the water to permit vessels to pass. The bridge is built across the confluence of the Tigris and Euphrates Rivers, which form the Shatt-el-Arab. Its central span of 30 yards is the movable portion, which lowers the bridge's roadway and a light railway enough to let a ship pass.



Bridge span lowers enough to give clearance to ship

POPULAR MECHANICS

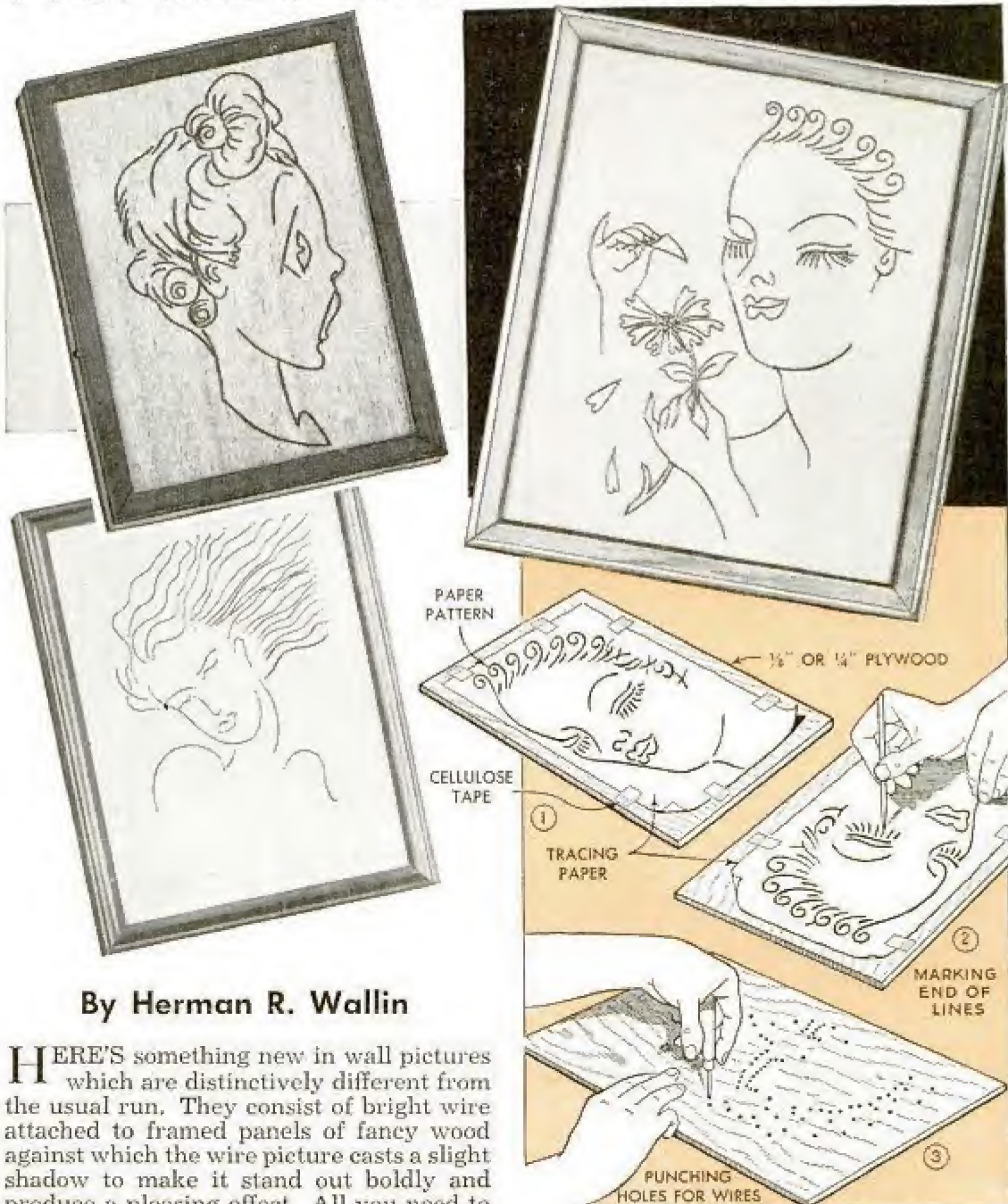
Wilmingtun, Del.

Brig. L. J. W. Smith



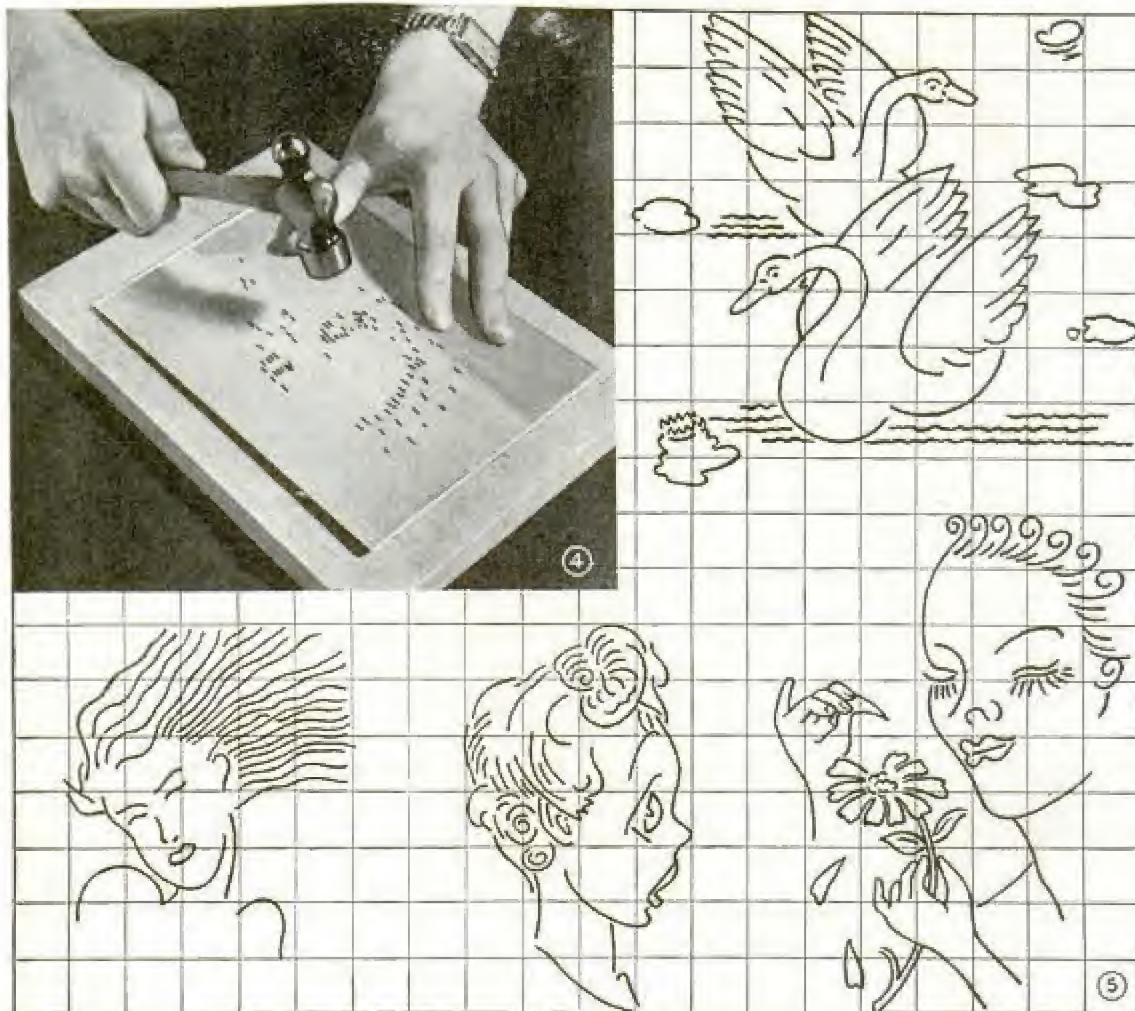
THE CRAFTSMAN

PICTURES "Embroidered" in WIRE



By Herman R. Wallin

HERE'S something new in wall pictures which are distinctively different from the usual run. They consist of bright wire attached to framed panels of fancy wood against which the wire picture casts a slight shadow to make it stand out boldly and produce a pleasing effect. All you need to



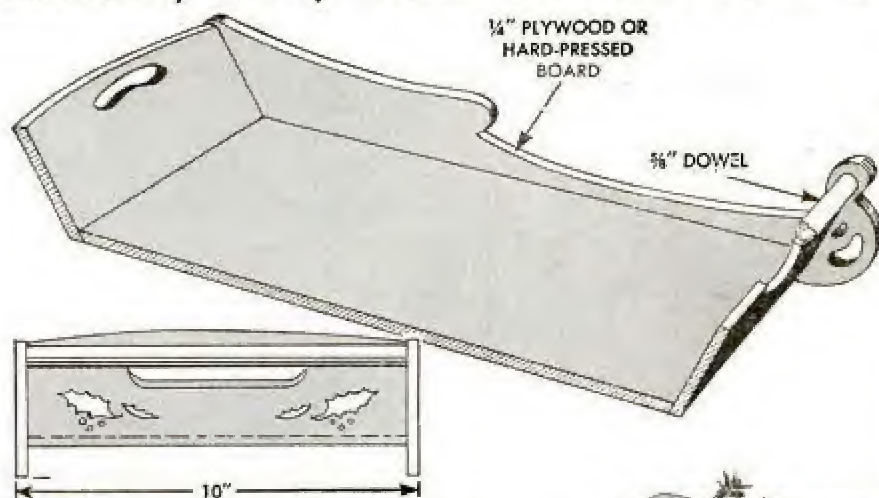
make these unusual pictures are pliers, a small hammer, an awl, some old wire from discarded radio coils and a few pieces of thin wood. Magazines and newspapers provide an excellent source for suitable pictures to copy. Look for those made up mostly of outlines such as the ones shown in Fig. 5. In tracing the picture, break up the lines into short lengths and avoid continuous lines. The wood should be selected to give the most pleasing contrast to the kind of wire used. Copper or enameled wire stands out nicely on light-colored woods, while brass or tinned wire looks best on darker woods. You can use fancy veneered plywood $\frac{1}{8}$ to $\frac{1}{4}$ in. thick in walnut, mahogany and maple, or the top and bottom of a cigar box will do. The wood is first sanded smooth and finished by staining and waxing, or by leaving the wood natural and applying wax or linseed oil.

Center the tracing on the wood so that there will be about 1 in. or so of margin all around to allow for framing and hold it in position with a few tabs of cellulose tape as in Fig. 1. Now, with an awl or a sharply pointed nail, make a prick mark at the be-

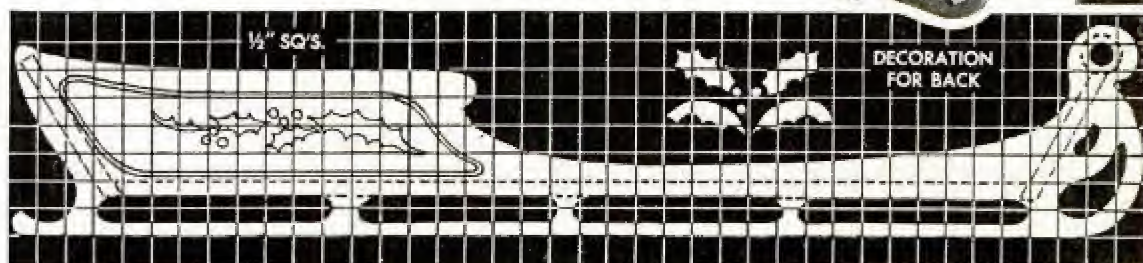
ginning and end of each line as in Fig. 2. After this, remove the tracing and with the same tool, or with a small twist drill if the wood is $\frac{1}{4}$ in. thick, make a hole through the wood at each mark. The size of the holes is governed by the size of wire used. A No. 22 or 20-ga. wire is about the right size. If the wire needs straightening, you can do so by drawing it over a dowel or other round surface. When all the holes are drilled, sand the front and back of the wood lightly to remove the rough edges.

From now on, it's just a matter of bending the wire to conform to the contour of each line of the pattern, which is done by laying it over the line to be copied and forming it with the fingers to correspond. At the ends of each line, the ends of the wire are bent downward with pliers to pass through the wood and extend about $\frac{1}{4}$ in. on the back. This procedure is followed until all the lines of the pattern are completed, after which the projecting ends are clinched as shown in Fig. 4 by turning the picture face down on a soft-pine block and hammering the wire down in the direction of the grain.

Holiday Tray Adds to Christmas Decorations



Although intended especially for serving guests during the holiday season, this appropriate sleigh-shaped tray also can be filled with fruit neatly arranged to provide an attractive table centerpiece. Identical sides of the sleigh are clamped or tacked together while jigsawing them to shape, after which the bottom, back and dash are assembled as indicated by the dotted lines in the lower detailed drawing. Finishing consists of enameling the outside white and trimming with red stripes, red berries and green holly leaves



Flannel Gun-Cleaning Patch Cut With Sharpened End of Tubing

Instead of tearing pieces from old rags for cleaning the bore of your rifle, use round flannel patches of the proper diameter and avoid the danger of wedging the cleaning rod in the barrel, which might necessitate harsh measures to remove it. To cut a supply of these patches quickly, first soak a square yard of cotton flannel in water and iron it smoothly after it has been stretched and dried. This tends to increase the flannel's absorbing qualities for oils or cleaning solvents. Then, fold or stack several thicknesses of the material on a smooth, hardwood block and punch out the patches with a tool made by sharpening the end of a length of tubing or pipe. Patches $1\frac{3}{4}$ in. in dia., are correct for .30-caliber bores, while $1\frac{1}{8}$ -in. patches are

right for cleaning .22-caliber firearms. For best results, patches should fit the bore snugly, requiring a firm pressure to push them through, but they must not fit so tightly as to have a tendency to bind or stick.—Clyde Baker, Oakland, Calif.

Nonflammable Grease Remover

A quick-acting solution, which combines the detergent action of soap with the grease-dissolving ability of solvents, is made by mixing rapidly together diglycol oleate, 1 oz., and water, 1 oz. This mixture is poured into another mixture consisting of butyl cellosolve, 1 oz., isopropyl alcohol, 10 oz., and carbon tetrachloride, 14 oz., while stirring. Before using this non-flammable solution, one should test its action on the dye in the fabric as some dyes may be slightly affected by it.

Checker Boards for Servicemen Fold Into Small Packages

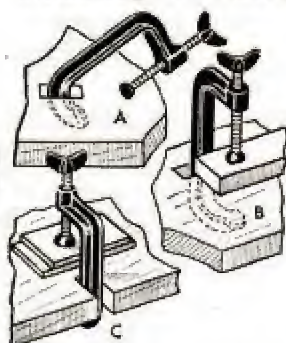


Photo courtesy of W. T. Mullarky, Gallup, N. M.

A group of volunteer workers of Gallup, New Mexico, known as the "USO Troops-in-Transit Project," is distributing checkers and boards to servicemen in transit who highly appreciate them as they can be folded into small packages and carried in the pockets of their uniforms. The boards are made by painting squares on oilcloth, or by utilizing oilcloth already printed in squares, and the checkers are made by sawing off thin disks from old broomsticks and mop handles, which are gathered by the local children. Small cloth bags having drawstrings to close them are made to hold the checkers, which are dipped in paint, a small nail being driven temporarily into each checker to serve as a finger grip while dipping it.

—Mrs. P. J. Vidal, Gallup, N. Mex.

Making C-Clamps More Useful



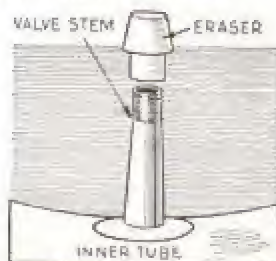
Here are a couple of methods of using C-clamps that one home workshop owner found useful. In the first method, a rectangular opening is made in the bench top to receive the clamp, which is inserted as shown at A, and then turned at right angles as at B. This method provides a bench clamp for which you will find many uses. The second method consists of cutting a slot in the edge of the bench top to receive the clamp as

shown at C. This method provides a handy arrangement which will be found useful for holding small work when gluing it, or for holding work when sawing it with a coping saw, or while planing, etc.

—A. H. Waychoff, Phoenix, Ariz.

Pencil Erasers Are Used as Caps To Cover Tire Valve Stems

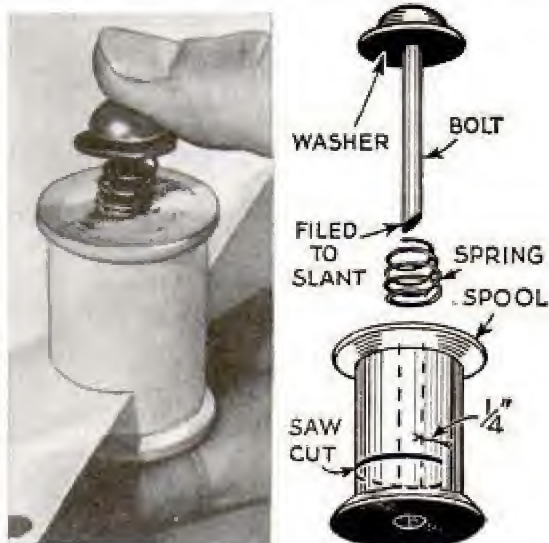
If you are unfortunate enough to lose the dust caps off of your tires and cannot obtain replacements, pencil erasers of the slip-on type will make good substitute caps. These can be obtained at your local drug or stationery store and are of suitable diameter to slip snugly over the end of the valve stems.



—James Vick, Church Road, Va.

Paper Punch Made From Spool And a Small Bolt

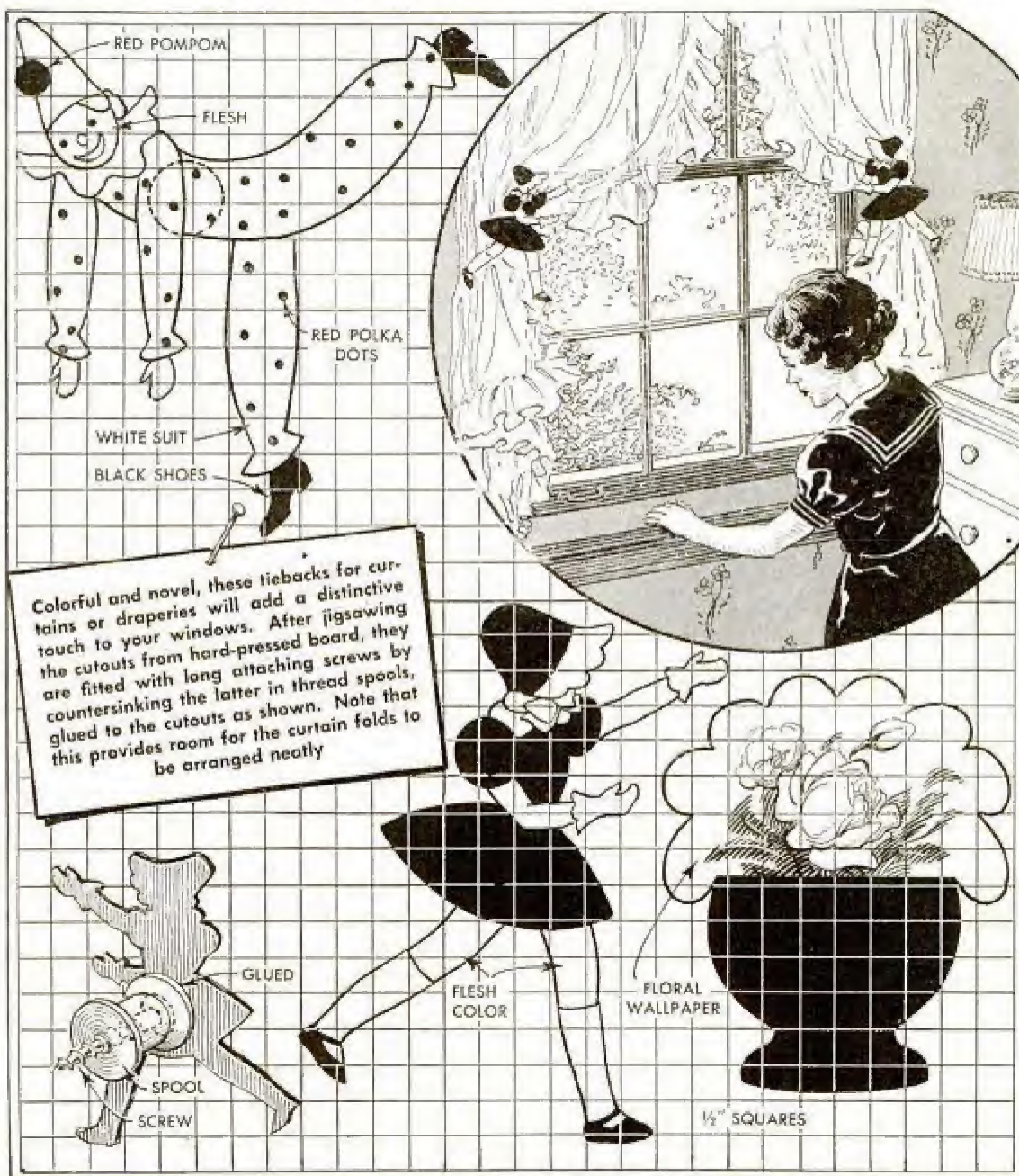
For an occasional job of perforating paper or light cardboard, a punch can be made from a small bolt, a spring and an empty thread spool. First, make a saw slot



a little more than halfway through the spool near one end. Then, select a bolt of a size to provide a smooth sliding fit through the hole in the spool. File off one end at a slant or bevel. Put a coil compression spring under the bolt head and insert the bolt into the spool. In use, slip the paper to be punched into the saw slot of the spool and push down the bolt.

—W. C. Wilhite, Carlinville, Ill.

Novel Curtain Tiebacks Add Color to Windows



Proper Care Will Greatly Increase Life of Bicycle Chains

Probably the chain is the most neglected part of a bicycle, yet it should have frequent attention. It must be cleaned at regular intervals, and oiled correctly. Most chains have a connecting or snap link that can be removed to take off the chain without removing the rear wheel. However, these links should not be pried apart with a screwdriver or other similar tool. Instead the chain should be slackened and grasped on each side of the link, after which the latter is bent sideways gently,

causing the two connecting link pins to approach each other. With the pins in this position, the cover plate can be removed with the index finger. After cleaning the chain in kerosene, it should be lubricated with a light-bodied oil, brushed on or applied with an oilcan to the upper edges of the side plates. Then the chain should be laid aside until the oil has penetrated the pin-bushing joints. Graphite sticks, grease or heavy oil should never be used on a chain as they will not penetrate the joints.

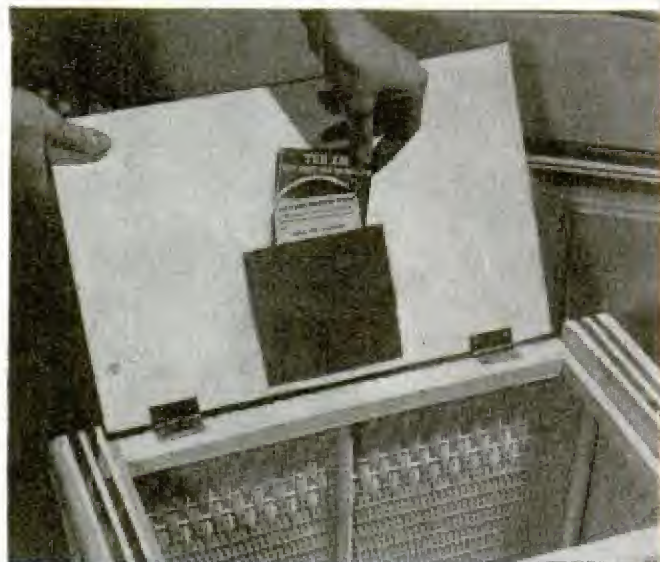
Solving HOME



After laundering a cloth belt, which must be stretched and held smoothly while drying, just slip it over a shortened curtain rod of the telescoping type



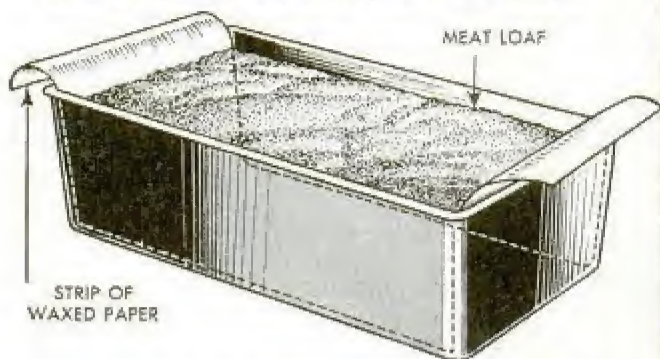
The nuisance of having a cloth slip from your fingers when straining juices or other liquids into jars can be overcome by using a sack for this purpose



When removing washing or cleaning directions from new garments, it's good practice to keep them in a heavy envelope glued to the lid of your clothes hamper



Before washing or dry-cleaning a garment, it's a good idea to sew around any large stained areas so they can be located easily when the cloth is wet

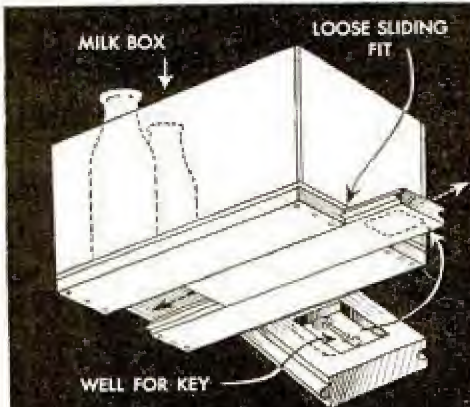


To simplify the task of lifting a meat loaf from the pan, one housewife places a strip of waxed paper in the pan so that both ends extend over the edges



Place pieces of an old sponge in the bottom of your flower pots to help retain moisture and you won't have to worry about watering plants so often

PROBLEMS



Fitted in a false bottom screwed to a box for holding milk bottles at the back door, a recessed pull-out panel makes an excellent place to hide keys



Two pigeonholes in a desk will serve as a lockbox for personal papers if a sheet-metal cover of the type shown is provided and fitted with a small padlock



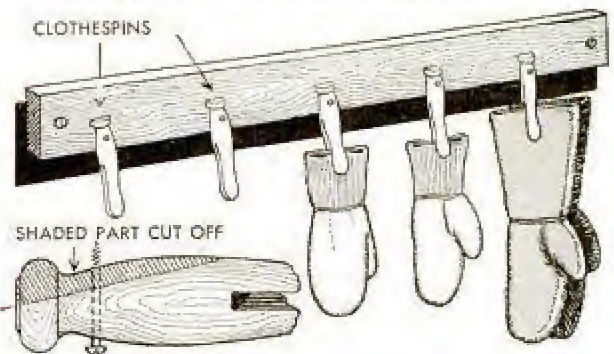
By painting half of a darning egg black and the other half white you can do mending with minimum eyestrain, as this provides a contrasting background



Time required to find a polish can and dauber in the shoe-shining kit is reduced to a minimum by fastening them together with a screw through the can lid

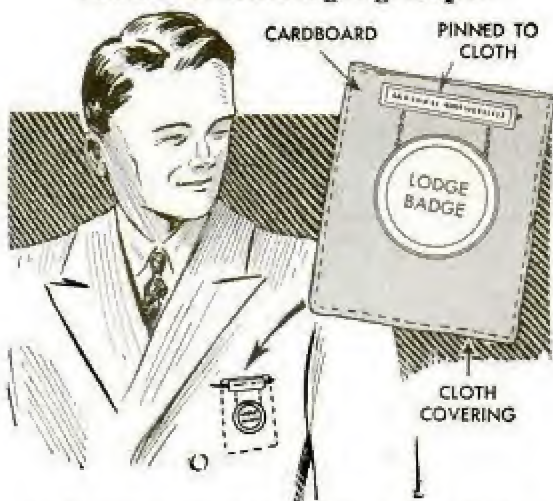


If the handle of your vegetable brush is loose, just remove it, drive a brad through the twisted shank and then force the wooden handle back in place



You'll find this easily-constructed rack for mittens and gloves a handy addition to your clothes closet as a mere downward pull releases the pair desired

Badges Worn on Coat Regularly Without Damaging Lapel



In lodges, conventions, etc., where badges are worn regularly, pinning them in the same position on a coat lapel or pocket soon tends to damage the material at these places. However, this can be avoided by attaching the badge to a cloth-covered piece of cardboard that fits snugly in the handkerchief pocket. Such a holder is hardly noticeable and the badge can be left attached to the cardboard permanently, if desired.—R. Boettinger, Englewood, N. J.

Substitute for Jack-O-Lantern From Sack and Flashlight



By painting faces on two sides of a large paper bag and slipping a flashlight into the mouth of the bag, one boy made a good substitute for a pumpkin jack-o-lantern. The bag should be made of thin paper for best results. The two

faces should have different expressions so that you can change from one extreme to the other merely by turning the bag.

Dash Signal Operated by Brake Shows When Emergency Is On

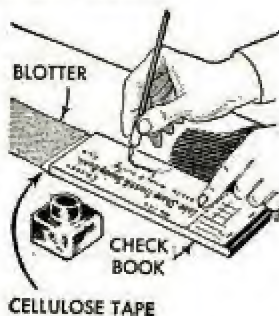
If you sometimes forget to release the emergency brake of your car before backing out of the garage or pulling away from a parking space, here's an easy way to hook up a warning light to show when the brake is on. First, secure a pushbutton switch of the type that opens the circuit when pressed, mount this directly in front of the emergency-brake lever so that the latter

presses the button when the brakes are released, and connect it to a small lamp fitted in the dash. Then, wire this dash signal through the ignition switch so that it operates only when the latter is turned on, thus avoiding unnecessary use of current when the car is parked.

—Richard Shafer, Pasadena, Calif.

Blotter Attached to Check Book Is Always at Hand

Instead of carrying a separate blotter to use when writing checks, I cut one to fit the check book and attached it with cellulose tape as shown. In this way, the blotter is always conveniently at hand to take up excess ink without waiting for it to dry, thus saving considerable time where a number of checks are written.



—Paul Toomey, Bronx, N. Y.

How to Sharpen Common Pencil To Strengthen the Lead

The point of a regular pencil can be prevented from breaking easily when used on rough wood by shaping the point as shown. This method provides much stronger support for the lead than when the wooden part of the pencil is tapered more. If a sharp knife is not handy, a chisel can be used to advantage. In some cases, a coarse file is handy for shaping the point.

—J. Modroch, Danbury, Conn.

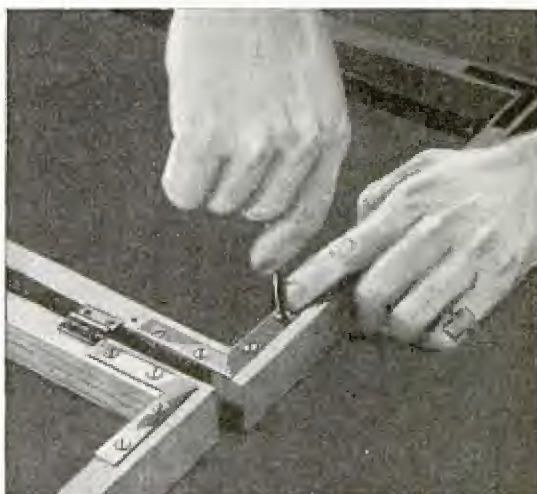




Suitcase-type **CARD TABLE**

THIS folding card table is carried like a suitcase and has space inside to hold several decks of cards, pencils, paper and even a set of poker chips—or a tablecloth for occasions when you wish to use the table for picnics. Also, the table can be adjusted for use as an inclined drawing board.

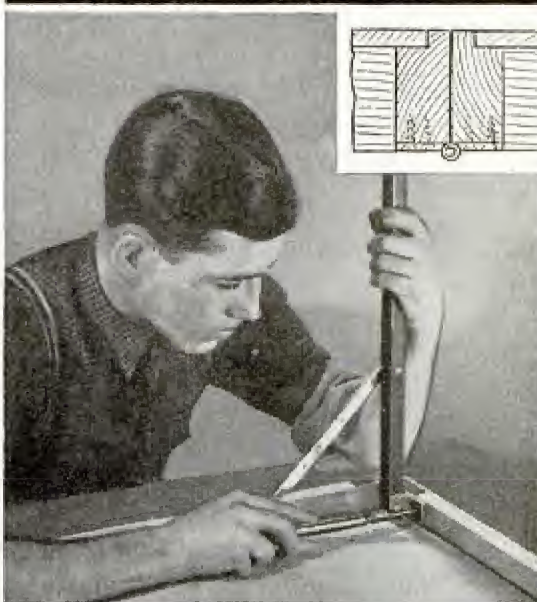
The legs and hardware of an old card table are used so that all you have to make is a new top, which consists of two equal parts to be hinged together. The rails must be wider than the thickness of the legs and the rail edges are rabbeted to take plywood or hard-pressed board, which is glued in place. Two of the legs—one in each part of the table—are set in from the corners, so that the pair in each half will lie side by side when folded. To provide support for the legs that are set in, the braces of these legs are screwed to wood blocks glued to the underside of the top. A friction clasp is provided to hold the halves of the top together when it is carried.



CORNER IRONS STRENGTHEN BUTT JOINTS



LEG BRACES FASTEN TO WOOD BLOCKS



LEGS AND HARDWARE USED FROM OLD TABLE

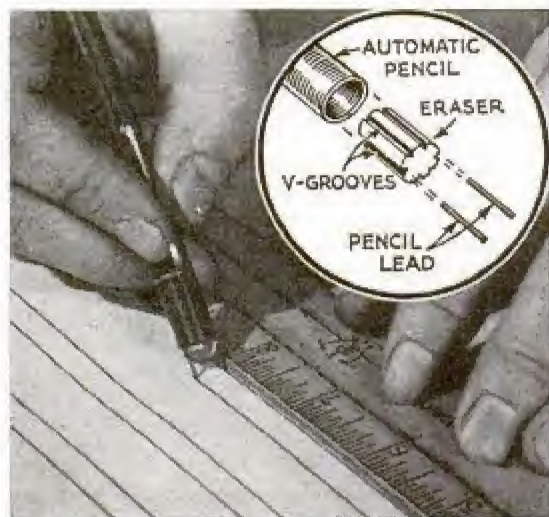
Micrometer Aids in Estimating Number of Labels on Hand



As it is often advisable to compare thickness of paper stock and check the number of labels, letterheads, etc., when purchasing such items, I have found a micrometer especially handy for doing this quickly. For example, the micrometer shows a label to be .0035 in. thick. By measuring the stack with an ordinary ruler, the number of labels in it can be estimated easily if they are printed on the same stock, as 3.5 in. will equal approximately one thousand labels.—Frank Shore, New York City.

Two Leads Held in Pencil Eraser To Draw Double Parallel Lines

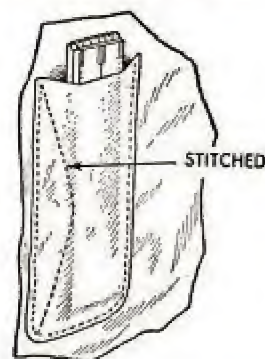
When you have occasion to draw a number of narrow-spaced parallel lines, the job can be done rapidly by using the eraser end of a pencil to hold a couple of leads. The eraser is grooved at the sides, the leads placed in the grooves and the assembly slipped into the eraser ferrule, leaving the



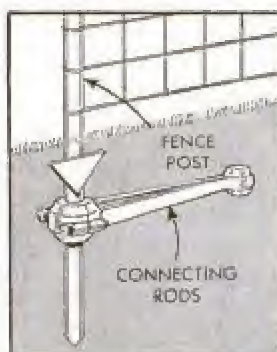
ends of the leads projecting a suitable distance. Cutting several grooves of different spacing will enable you to vary the spacing of the lines as desired.

Pocket Stitched to Hold Rule

After losing several folding-type rules because they could slip out of his overalls pocket easily, one carpenter had a portion of the pocket stitched shut as shown. This reduced the size of the pocket at the center to provide a snug fit for the rule, leaving the top with full opening so the rule could be inserted quickly.



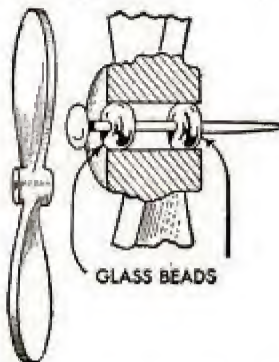
Large Gate Posts Braced Easily With Old Connecting Rods



Invisible bracing for steel posts of a yard gate can be had by anchoring them through discarded auto connecting rods, which are buried in the ground. The rods should be just a few inches under the surface and should be located parallel with the fence. Two or three coats of paint applied to the rods before putting them in the ground will help prolong their life.

Glass Beads Provide Bearings For Model Airplanes

If you wish the wooden propeller of a model airplane to run freely, use a couple of glass beads as bearings. These are inserted into a hole in the center of the propeller with a press fit as indicated. A pin will serve nicely as a propeller shaft, and should be of a size to fit the holes in the beads with very little play.



Simple Methods of Preserving Fishing Tackle



A little time spent occasionally on caring for your fishing equipment will be well worth while in making it last longer and give the best of satisfaction, especially on tackle that is difficult or expensive to replace. For example, your valued feathered baits will be less likely to disintegrate if a film of model-airplane cement is kept on the threads that bind the feathers, Fig. 1. This treatment also is good protection for the wrapping on gutted hooks. Another thing to keep in mind is the care of your casting rods. One of the most common causes of damage to tubular steel rods is rust inside them. On all rods of this type, except the telescoping ones, rust can be effectively checked by coating them inside with a film of linseed oil. On rods of open-end construction, the application is simple. Just hold your finger over the lower end while oil is poured in at the upper end to fill the rod as in Fig. 2. Then, by standing the rod up to drain, the interior will be completely coated and fully protected. Servicing the one-piece tubular steel rods is not quite so easy, but they can be protected by drilling a tiny hole through the side at a joint for the introduction of oil. After the inside surfaces have been coated thoroughly with oil, the hole should be plugged with solder. For preserving your



casting plugs, you will find auto touch-up enamels handy, Fig. 3. These are available, in many colors, at most auto-parts stores.

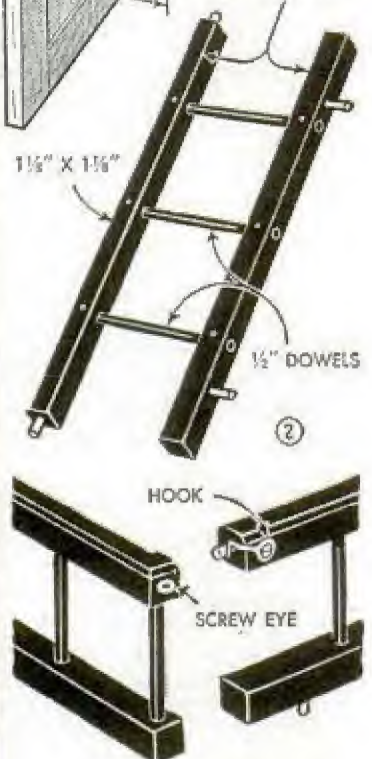
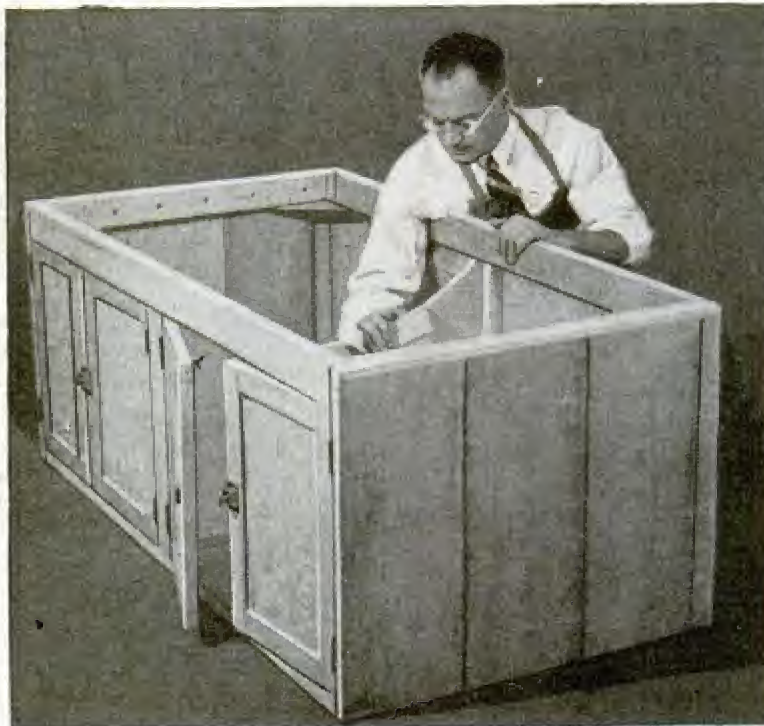
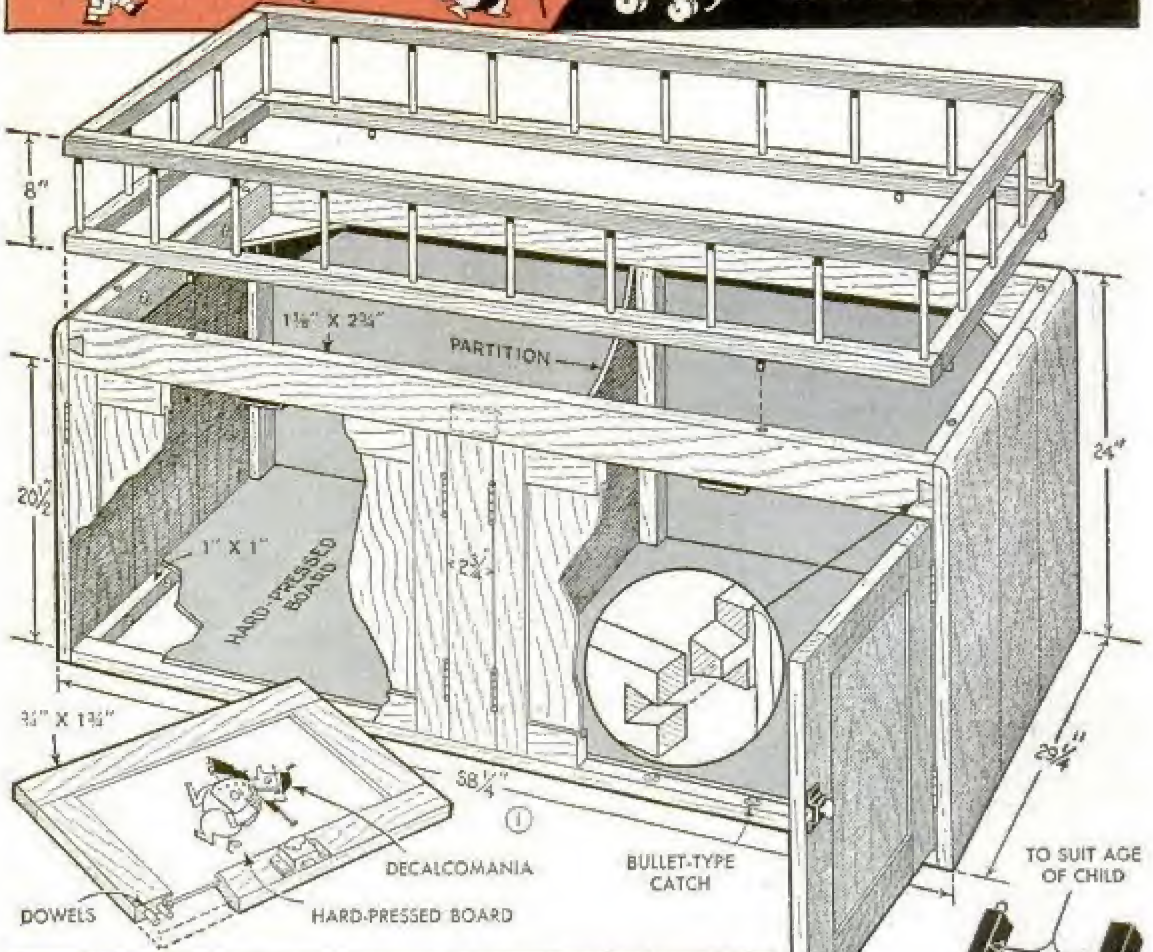
Baseball Clogging Basement Drain Removed Easily With Corkscrew

When a floor drain near the laundry tubs in my basement became clogged, I tried to remove the obstruction with a long flexible spring, as I was quite sure that the stoppage was due to a baseball which had rolled into the drain. Although the pointed spring prong seemed to reach the ball, this only caused it to turn, as the prong did not pierce the cover enough to get a firm grip on it. To solve this problem, I soldered a cork-

screw onto the end of the flexible spring and with this improvised tool removed the ball in ten minutes.

—Wm. A. Winters, Sr., Milwaukee, Wis.

¶ If you have trouble slipping a new windshield glass into the rubber weatherstrips when replacing a broken one, just squirt a little liquid soap into the weatherstrip grooves to serve as a lubricant.



CHEST-BED

IN SMALL homes and apartments where it is impossible to furnish a room for the child, this combination bed and chest will be of real value, as it serves as a comfortable bed at night and provides storage space for extra blankets, toys and other household items. In daytime, removing the railings and covering the chest with an appropriate drapery converts it into a useful couch. If made higher than shown in Fig. 1, the railings can be removed and set up separately to form a child's play pen. When used in this way, however, a floor for the pen must be assembled and drilled for pegs to keep the railings in place.

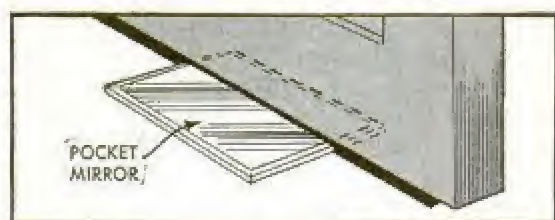
Before assembling the frame, have the springs at hand so they can be measured, as the exact size of the chest depends upon these dimensions. Corners of the frame are dovetailed and glued, with triangular blocks glued and screwed to the underside of the top members at each corner to support the springs. Note that the ends of the chest are built up of tongue-and-groove stock, glued and screwed to the frame. To improve the appearance, the outer edges of these boards are rounded at the top.

Note that the chest is fitted with a partition which is curved at the top to prevent the springs hitting it when they are pressed down by weight of a person sitting or lying on them. Railings are assembled quickly by clamping the upper and lower members together and drilling them both at the same time. The holes should be just large enough to provide a sliding fit for the dowels, these being held in place by glue and small finishing nails driven in from the sides. To prevent shifting of the railings, tapered pegs are fitted in the lower members to correspond with holes drilled at the top of the chest frame as shown in Fig. 2. End railings are also fitted with pegs which slip into holes drilled in the side railings. Hooks and screw eyes lock the railings together.



Doors are hung with hinges having removable pins for convenience in detaching them, in case the edges need planing to make them fit accurately. A stop block at the top and bullet-type catches in the bottom rail hold the doors shut. Or, you can fit them with elbow catches and cabinet latches, if desired. Although the bed is somewhat higher than cribs in general, this gives the advantages of adding to the storage space, Fig. 3, and facilitating making the bed with a minimum of stooping for the housewife. Low railings are also a convenience where the bed is made without removing them. Decalcomania transfers are applied in the center of each door.

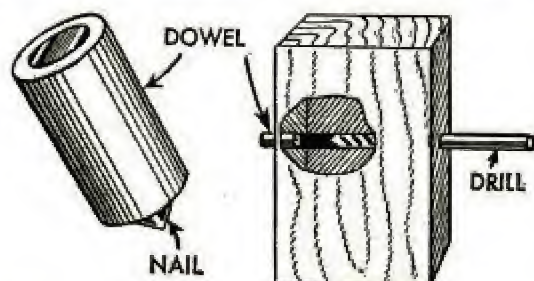
Bottom Edge of Door Inspected By Using Small Mirror



If a door binds and you suspect it is caused by moisture penetrating the bottom edge because it has not been painted, you can make sure without removing the door by using a mirror to look at the edge as shown. The mirror is also ideal when fitting a door to see where it should be planed to prevent dragging.

Inexpensive Set of Dowel Markers Assures Neat Joints

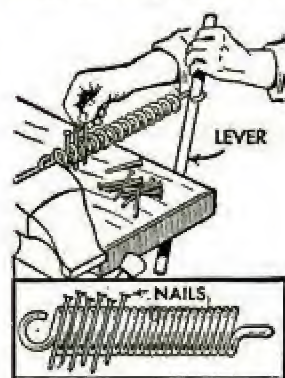
A handy set of dowel markers, which eliminate considerable measuring to fit doweled joints accurately, can be made in a few minutes by carefully fitting short dowels of various sizes with nails having sharpened points. In doing this, it's a good



idea to drill guide holes slightly undersize through the dowels to assure accurate centering of the nails and prevent them from splitting the wood. To center-mark the short dowels quickly, just drill holes, corresponding in diameter with the dowels, through a block of wood, tap the dowels in them and use the drill points for marking the ends as shown in the lower detailed drawing. Some sanding of the dowel sides will facilitate inserting and removing the markers, as stock dowels usually fit snugly in holes for which they are made.

Easy Way to Install Heavy Springs

After removing a strong coil spring from a restricted place, I found that it was impossible to replace because there was insufficient space to stretch it to reach the



supports either by pulling or by means of leverage. After trying various methods, I measured the distance between the two supports that held the spring. Then I clamped one end of the spring in a vise and stretched it to the desired length by means of a

lever as indicated. While holding the spring in this position, nails were inserted between the coils to keep it extended. In this way the spring was hooked on its supports easily, after which a slight pull sideways from the center of the spring permitted the nails to be removed.

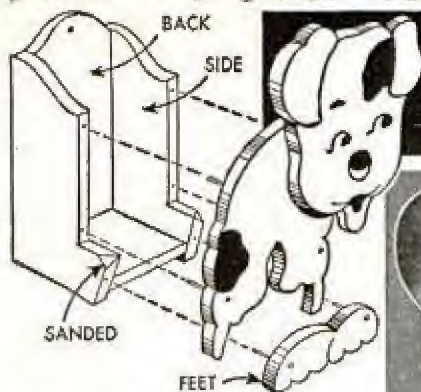
—I. H. Gaskin, Watertown, Mass.

Ends of Building-Trim Patches Cut at Angle for Good Fit

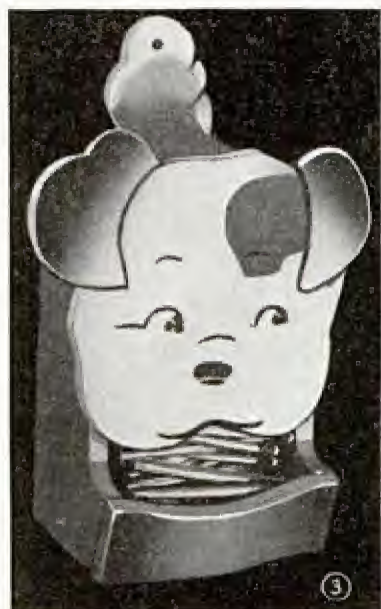
When you patch corner boards and trim on buildings, cut the joining ends at an angle as shown, instead of squarely across. The angle cut makes a neater fit of the patch piece. Paint the ends of the joining parts before nailing them in place so that water running down the corner board will drain away instead of soaking into the end grain of the wood.



Novelty MATCH BOXES



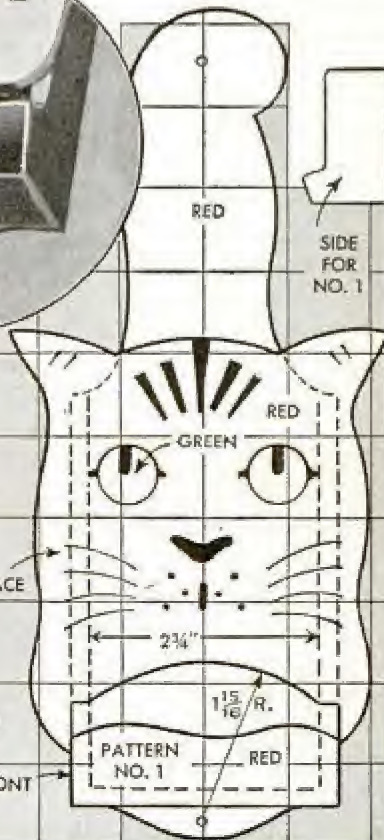
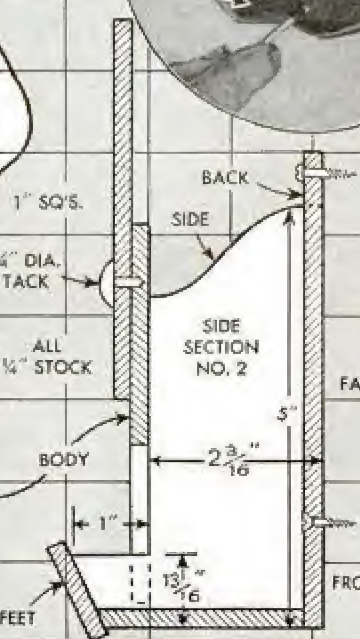
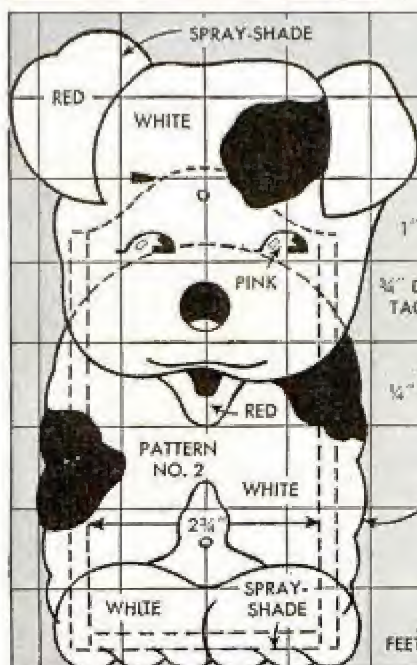
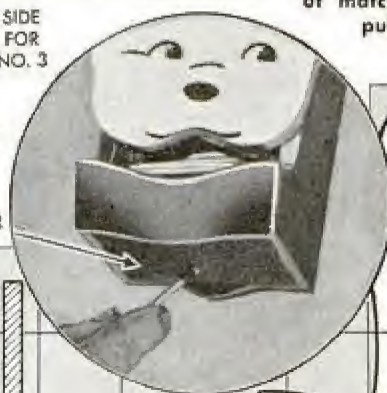
for the Kitchen



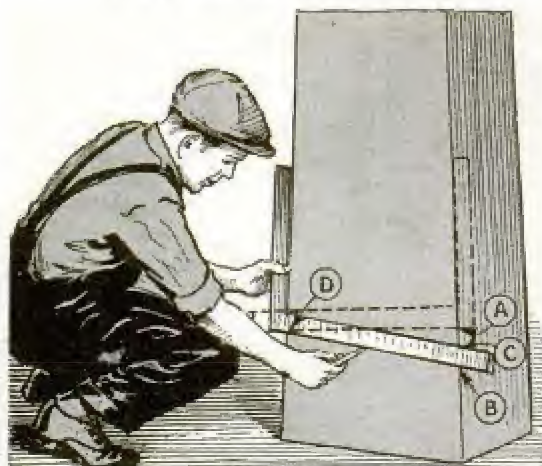
You can use plywood scraps or solid stock for these boxes, which are mostly jigsaw projects. Each has a sandpaper striking surface on the bottom, and is loaded by inserting a box of matches inside it and then pulling off the cover

SIDE FOR NO. 3

SANDPAPER

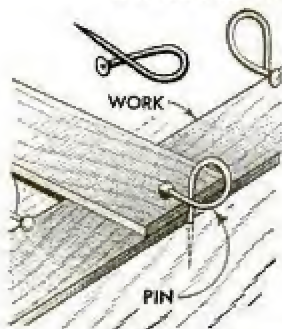


Squaring Tapered Wood Column For Accurate Sawing



The next time you have to fit a tapered column, such as those commonly used on porches, try this method of squaring the ends for accurate sawing. First, place your carpenter's square on one edge of the column as shown and make a dot at points B and D. Next, reverse the square to the opposite edge as indicated by the dotted lines and mark point A. Then, halfway between points A and B, mark position C, and draw a straight line from C to D. Follow this same procedure on all sides.

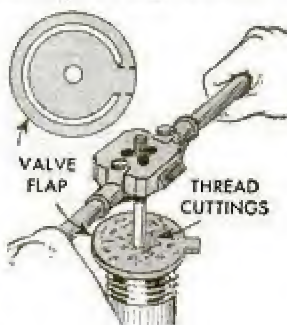
Bent Pins Provide Spring Clamps To Hold Model Parts



To hold small parts in model work for gluing or assembling, one modelmaker uses large pins. These are bent so that the heads will press on the pieces to be held when points are stuck in the bench.

Valve Leather Catches Cuttings While Threading Pump Rod

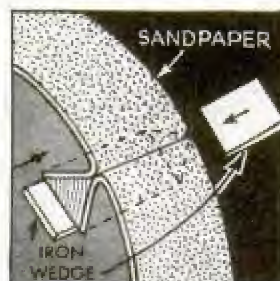
If it is necessary to recut the threads on a pump rod while the pipe and rod are still suspended in a well, there is always the possibility of thread cuttings dropping into the pipe and eventually injur-



ing the cylinder valves. To avoid this, one plumber made a simple cover for the pipe by cutting the flap from a discarded valve leather and enlarging the center hole so that it fits snugly over the rod as shown.

Sandpaper Is Locked on Drum Without Leaving Bump

Turned from a piece of straight-grained maple, this handy sanding drum is fitted with a triangular-shaped wedge which locks the ends of sandpaper strips in place and eliminates the



usual bump at this point. To cut the wedge opening, just drill two small holes at the inside corners and remove the piece with a jigsaw. Then drive tapered pieces of metal under the wedge to tighten and force it against the sandpaper ends as shown.

—Harold Bulmore, Newfane, N. Y.

Danger in Cleaning Auto Motor To Be Avoided

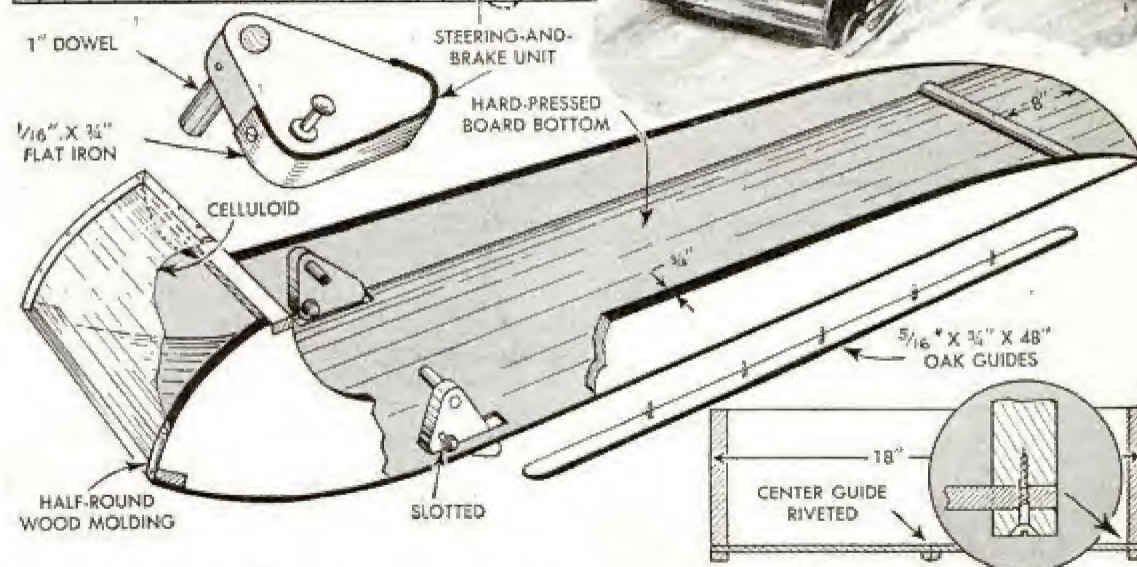
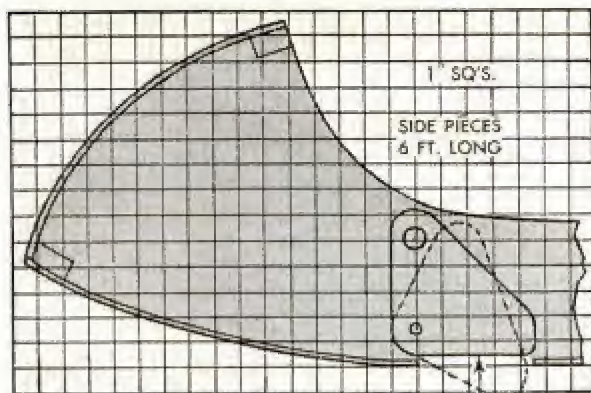
Before using inflammable solvents and ordinary paintbrushes to remove dirt and grease from a car motor, always disconnect the battery leads. This eliminates one danger of serious fires when doing such work, especially where brushes are used that have metal bands around them, as these might cause a short circuit accidentally and ignite the solvent.—L. C. Fry, Atlanta, Ga.

Food Grinder Serves as Clamp When Gluing Small Parts

When several small pieces of wood are being glued together and regular clamps are not readily available, it is often difficult to apply adequate pressure on the pieces while the glue dries. However, if an ordinary food grinder is at hand, the clamp on it can be used for the purpose. It's best to dismantle the grinder entirely so that the handle will not interfere with screwing it onto the work.



Coaster Has Sides and a Built-In Windshield



Icy winds will not sting your face when you ride this coaster because it has a celluloid windshield. And, instead of wearing out the toes of your shoes in guiding it, steering is done by means of two iron-shod blocks, which are forced down through slots to cause a drag that turns the coaster to one side or the other. When both blocks are forced down, they act as a brake. The

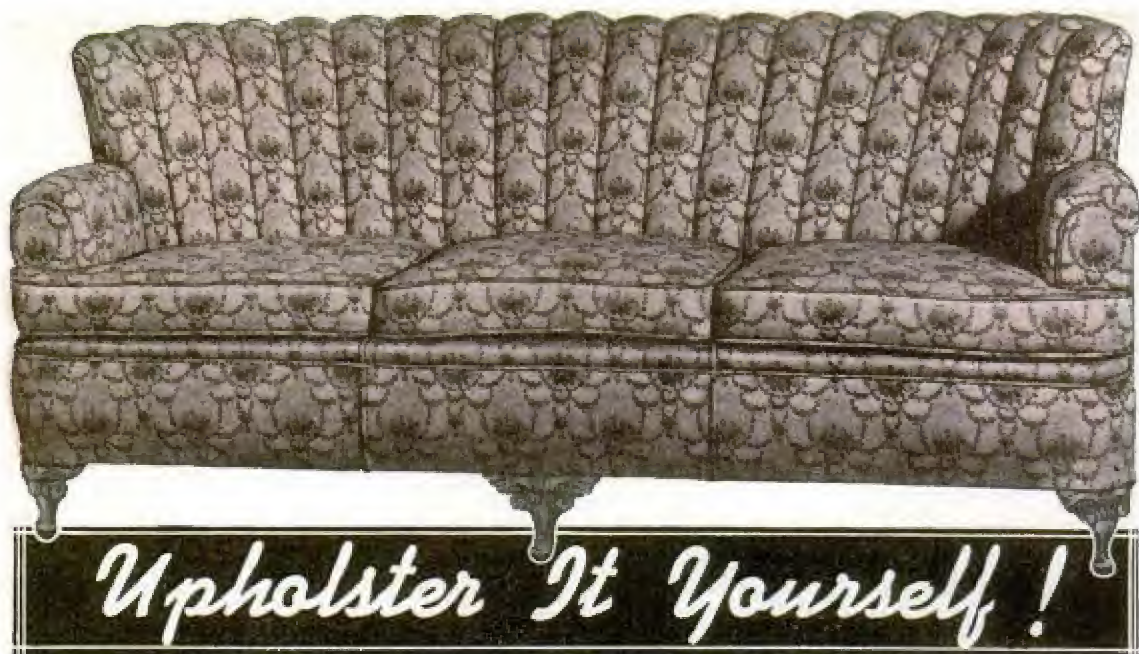
side members are notched for two cross-pieces at the forward end. The bottom of the coaster is made of tempered hard-pressed board glued and screwed to all contacting surfaces. Three guide battens keep the sled on a straight course, the center one being riveted to the bottom, the outer two attached with screws driven through the bottom into the side members.

Keep Your Flashlight Clean to Get Maximum Battery Life

Keeping a flashlight in good working order is important if you are to get maximum service from the battery. The cells are not always at fault when a flashlight burns dimly. There may be a resistance to the passage of current caused by corrosion in the switch or other parts. Or, the trouble may be caused by poor contact between the cells. When this is the case, a metal disk, preferably copper, placed between the cells as indicated usually clears up the trouble.

(To move a refrigerator easily, wet the linoleum under it and rub on cake soap. This will make the refrigerator slide easily.





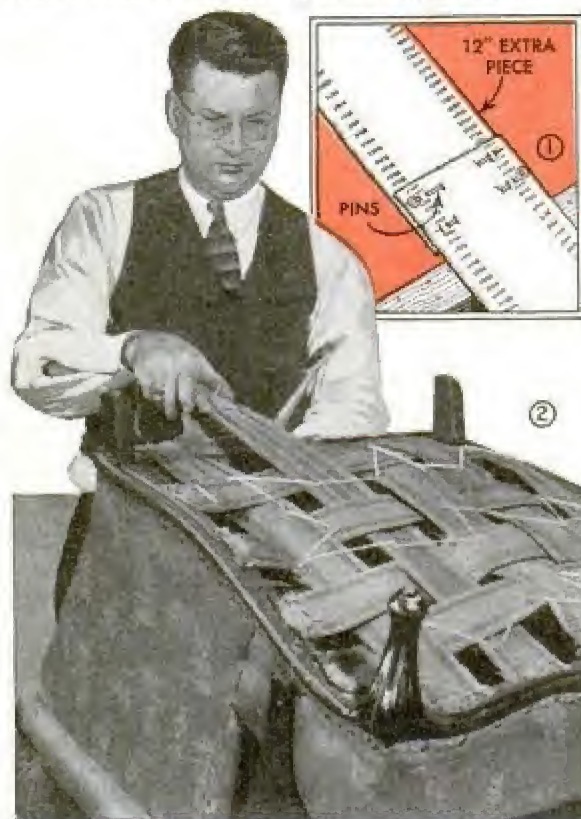
By Charles E. Troutt

UPHOLSTERING old living-room furniture to renew it and give it many additional years of service requires only a few inexpensive tools. You can cut the new covering without worrying about it fitting, as the original material, if removed carefully, will provide a perfect pattern. Other than the covering selected, there will

be little new material needed, the old springs, stuffing, webbing and burlap being reused to cut down cost. In some cases, however, additional stuffing such as hair, moss, fiber, etc., may be required. In all cases, a small amount of layer cotton will be needed. These items are available from upholsterer's supply houses and most large department stores and mail order houses.

For upholstering furniture successfully, the following tools will be needed: A pair of scissors, ice pick (used as a regulator for shifting filling in stitched edges), tack hammer, a dozen upholsterer's pins, one 7-in. curved upholsterer's needle and one smaller curved needle (size from 3 to 5 in.). If the piece of furniture to be recovered has a web base, you will also need a webbing stretcher, which can be purchased or made easily in your own shop. These tools are shown in Fig. 3.

Removing old cover material: As this will be used as a pattern for cutting the new cover, it should be removed carefully. A screwdriver and wooden mallet or hammer are satisfactory for this purpose. In removing tacks, place the screwdriver under the material, next to the frame and against the tack as in Fig. 4. A few light taps with the mallet, and the tack is out. Do not pry the tacks out by twisting the screwdriver, as this will damage the wood. Label each piece of the old cover as it is removed and make any notes which might help you in fitting the new cover. On some pieces of upholstered furniture, it is necessary that

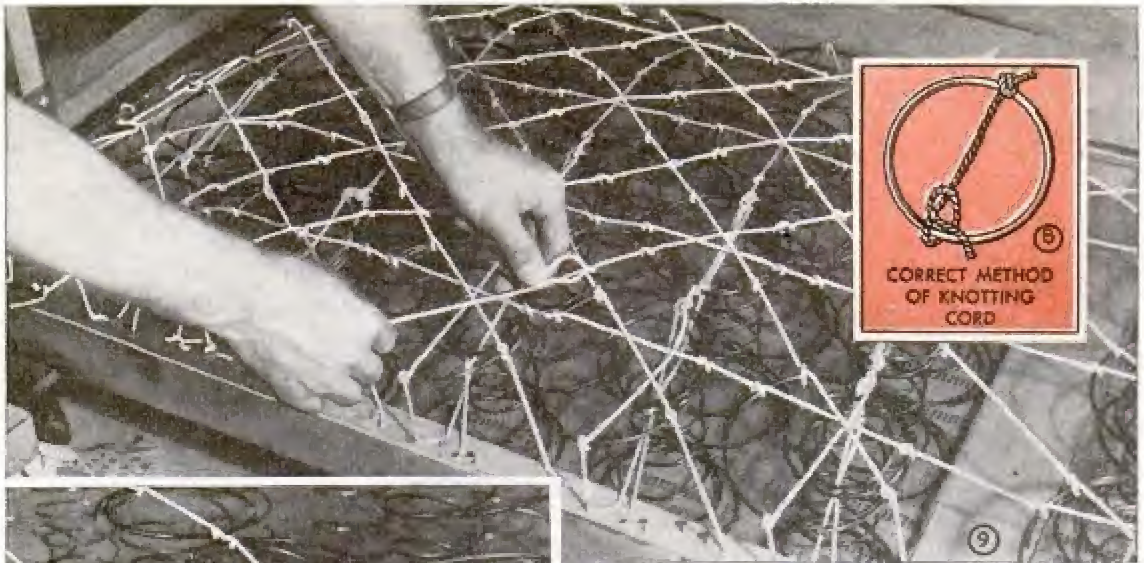




the arm covering be put on before covering the back. Sometimes the reverse is true. Note also whether the back cover material is tacked to the inside or front of the back leg. If your divan has a piped back like the one at the top of the opposite page, the position of these pipes should be marked on both the top and bottom rails as the cover is taken off. The burlap or other spring covering should be removed also, as in most cases it is necessary to straighten and retie the springs. After all cover material and filling have been removed, the frame should be examined for loose joints and repaired, using glue, new dowels, corrugated fasteners, hardwood corner blocks or other means to strengthen it. Any exposed wooden parts such as legs or top back rail in need of refinishing should be done at this time.

Repairing web base: If your furniture has bar springs (springs mounted on metal bars), examine these for loose nails. Bent bars should be removed, straightened and renailed. If the piece has a web base, check for sagged webbing. In case this needs repairing, first remove the tacks from one

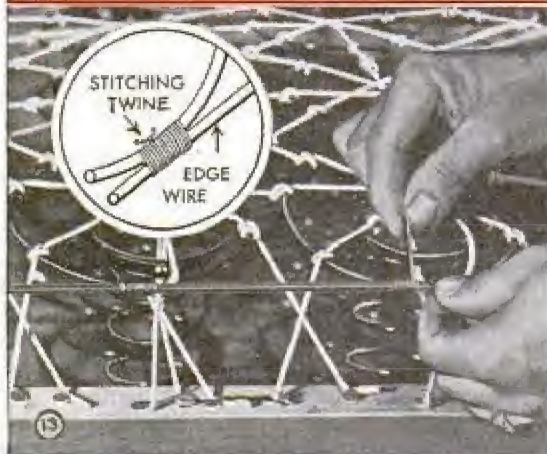
end of a piece of webbing. Then, pin a piece of this material to the loose end, making the lap the length of the piece turned over on the old webbing as in Fig. 1. This extra piece (about 12 in. long) is pinned to the old webbing to facilitate the use of a webbing stretcher as shown in Fig. 2. If the webbing is too frayed for the pins to hold sufficiently, it may be necessary to clamp two hardwood blocks over the joint and draw them up tightly with a C-clamp. Stretch one piece at a time and tack with four or five tacks (6-oz. size). Remove the extra piece of webbing, fold back the end of the piece you have stretched and tack with an additional six or eight larger tacks (12-oz. size). If new jute webbing is not available, a heavy cotton webbing will be entirely satisfactory in the event you pre-



11 SPRINGS LACED FOR TYING DOWN TO POSITION

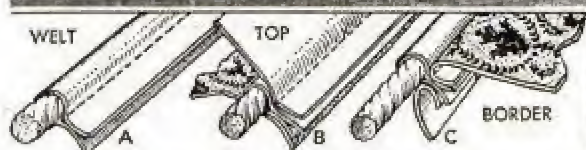


12 SPRINGS PRESSED DOWN TO DESIRED HEIGHT



fer to renew the old webbing completely. New webbing is laced as shown in Fig. 7, then pulled taut with a stretcher held as shown in Fig. 5.

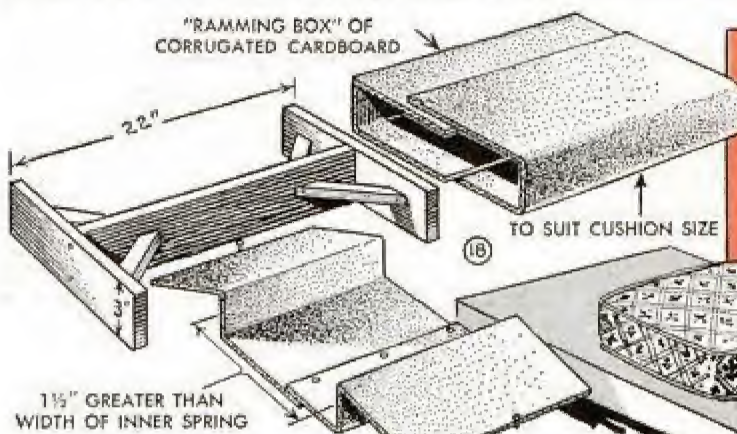
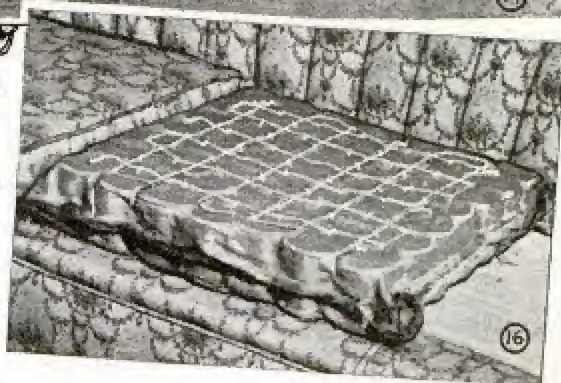
Retying springs: Many times a new upholstery job is necessary because the springs have shifted their position with use. For this reason, the springs should be fastened securely to the webbing in the manner shown in Fig. 6. Fasten each spring in four places, using regular upholsterer's stitching twine. At each point of fastening, tie a good knot on the bottom. If a spring is merely sewed round and round, it will shift in the event the twine breaks at a later date. Proper tying down of springs is a large factor in both the comfort and long-wearing qualities of an upholstery job. Detailed procedure for this important operation is shown in Figs. 9 to 12 inclusive. Note in Fig. 11 that the twine is tacked to the back rail first and tied to the rear side of the rear spring about two coils down from the top. Note also that the springs are tilted slightly toward the back as they are tied so that when the springs are pressed down to the proper height, Fig. 12, they will be pulled into an upright position. The twine is looped (not tied) around the front spring as shown in Fig. 10 and anchored to a large-headed tack driven into the rail. The looping permits shifting the spring into an upright position, after which the twine is carried up over the top coil to which it is tied and then carried back across the top for a distance of two or three springs where it is finally tied (study Fig. 9). Now, a second twine is run back up through the front spring parallel to the first piece which was only looped, but this time tying the spring. This step is shown completed to the left in Fig. 10. The proper method of knotting the twine is shown in Fig. 8.

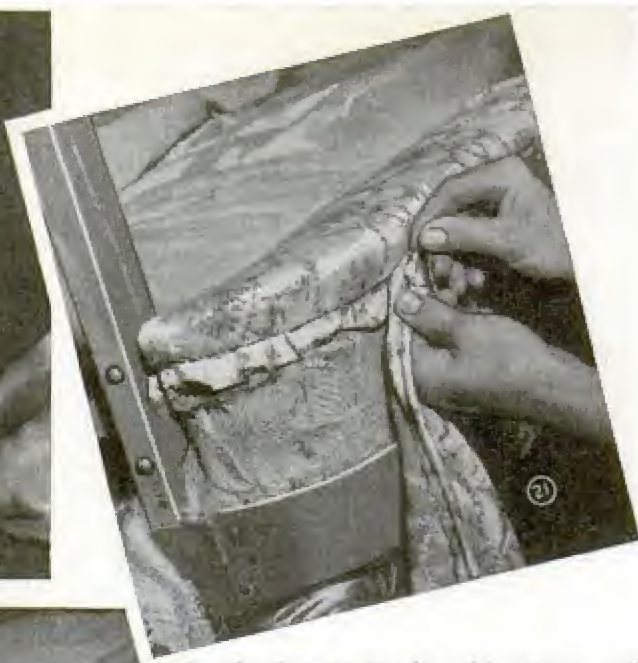


(15) CORRECT WAY TO SEW WELT CORD TO CUSHION TOP AND BORDER

Each row of springs is tied from back to front first, then from side to side and finally, diagonally as in Fig. 9. Note that the twine is tied to every piece of twine which it crosses between springs, in addition to being tied at every point where a spring is touched. Tying the edge wire to the front row of springs with stitching twine is done as shown in Fig. 13. Springs in the back are treated in the same manner as those in the seat, except for the edge wire, which is omitted.

You are now ready to cover the springs with burlap. If there are any holes in the old piece, they can be patched with material from a burlap bag. In the event the burlap is not in condition to use again, it can be replaced with Osnaburg or denim, which are entirely satisfactory as substitutes. Cover the bottom springs first. Next,





cover the back springs, tacking the cover to the bottom rail first, then to the top rail, beginning near the center as in Fig. 14.

Re-covering the cushions: At this point, the cushions should be re-covered, as they will be used later to determine the amount of stuffing needed for the arms and back, which are filled out to the cushions. By using the old cushion covers for patterns, cutting new ones is a simple procedure. You will, of course, have to use new welt cords. A welt cord is made by covering a heavy cord with top cover material and stitching on a machine close to the cord as shown at A in Fig. 15. A half foot, which is standard equipment on most home sewing machines, is used in the stitching. A piece of material $1\frac{3}{8}$ in. wide is sufficient to cover the cord and allow for sewing to the cushion on three sides. Detail B shows how the top and border pieces are held for stitching to the welt which conceals the raw edges when the cover is turned inside out as at C.

Some new cotton is necessary in covering the spring units, Fig. 16, as old cotton is usually packed and lumpy. Smooth out

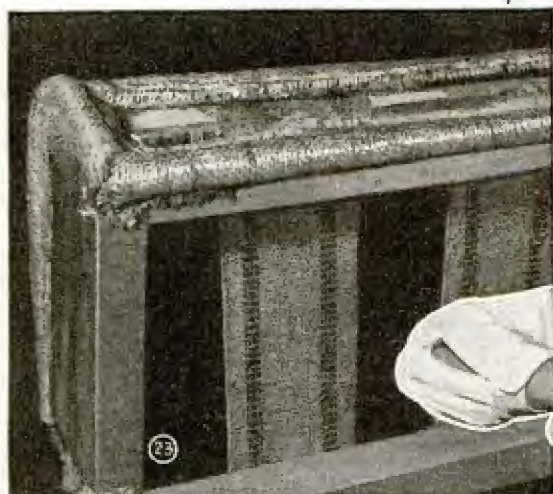
the lumps in the old cotton and tear off even with the edge of the spring unit. Then, wrap the unit in a layer of new cotton, letting this layer project over the edge as in Fig. 17. One layer of new cotton is sufficient where old cotton is also used. To slip this unit into the cushion cover without displacing the cotton layer requires a stuffing jig like the one shown in Fig. 18. This jig consists of a ram and a box in which the cotton-covered spring unit is

placed, after which the cushion cover is pulled over it. The ram is used as in Fig. 19 to hold the filling in place while the box is being withdrawn. The open end, which should be at the back of the cushion, is hand sewn.

Stitching the roll edge: If you like, the old roll edge can be used. Any soft spots should be regulated by inserting an ice pick through the burlap and shifting

APPROXIMATE YARDAGE OF COVER MATERIAL REQUIRED

Kind of Furniture	No. of Cushions	36-in. Fabric	50 to 54-in. Fabric
Wing chair	1	9 yards	5 yards
Wing chair	None	7 "	4 "
Club chair	1	7½ "	5 "
Club chair	None	5½ "	4 "
Wooden arm chair	None	2 "	1½ "
Arm chair (seat only)	None	¾ "	¾ "
Boudoir chair	1	5½ "	3 "
Boudoir chair	None	4 "	2½ "
Loveseat	2	12 "	7½ "
Loveseat	None	10 "	6¼ "
Divan (69 to 84-in. back)	3	16 "	9½ "
Divan (60 to 84-in. back)	None	10 "	7 "
3 piece suite	5	32 "	19 "



enough filling from other places to fill the soft spot. This regulating should be done as the roll is restitched. When restitching, start the needle in the front edge pointing up and permit it to go behind the edge wire. In returning the needle, go in front of the edge wire as in Fig. 20. Wind the twine around the needle as shown and pull tight. Repeat this operation until you have covered the entire front edge. If your job differs from this, replace the front edge as it was originally.

Putting on the top front band: The top front band consists of three pieces of the new material with a welt cord sewed between them. The center piece of the front band should be the same width as the center cushion and should match the pattern in the cushion material. Use your old cover for a pattern. Before attaching this band to the divan or chair as the case may be, sew it to a piece of under-cover material large enough to cover the seat springs. Cut this piece amply large, as it can be trimmed after tacking. Under-cover material, which will be directly under the cushions, can be of denim. Or, you can use service velour or sateen, if desired. Pin the completed front band to the burlap to hold it in place. Then, stitch the back edge of the burlap at the point where the denim is joined, catching under the springs wherever possible. Use a curved needle and stitching twine. Put an even layer of cotton under this band, tear-



ing it off even with the front edge. Pull the band down over this filling and hand stitch beneath the roll. A completely sewed top band is shown in Fig. 21.

Making the bottom front band: Also made in three pieces, the bottom front band has a welt cord sewed between each piece and along the top edge. This front band should be cut from the cover material so that the design will appear to continue down from the top band. Hand stitch this to the top band as in Fig. 21, running it straight and using a blind stitch, which is made by first inserting the needle through the top band, then through the inside of the welt cord on the bottom band.



sign is in the center. Tack the cover to the bottom rail (over the top of the seat cover), using only a few tacks. These tacks may have to be removed to make the pattern run straight. Put plenty of filling on the inside and over the top to give a nicely rounded arm, stitching the filling to the burlap in the same manner as the filling was stitched to the bottom. Large

tacks will hold the filling in place on top of the arm. Pull the cover material up over the inside of the arm, tack it to the bottom of the front post and then pull the material tightly over the post at the front edge and tack. Fig. 26 shows an arm properly filled. Note the roll around the inside edge of the post. Now tack the cover to the front edge of the post and pull the material tightly

toward the back of the arm and tack. Mold the filling to the proper shape by patting with the palm of your hand, bearing in mind that the filling always should follow the contour of the arm. Begin this patting process at the front and tack the cover under the arm as you go. Tack to the back post on the side or edge. This operation will depend on the manner in which your divan or chair was upholstered originally. Pull the cover around the inside of the front post, splitting where necessary to make a smooth fit, and tack to the front of the post as in Fig. 27. Pleat the material as you go around the top curve. The back covering of the divan is usually put on before putting on the outside arm covers.

Covering the back: Ordinarily, the back is in three pieces to match the design of the cushions and front bands, a welt cord being sewed between each of the panels. Turn the divan on its back and put in a layer of stuffing, stitching it to the burlap as you did before. It is necessary to have more filling in the back than was used in the seat, and it is also necessary that you take closer stitches. The back should be stuffed out far enough to reach the cushions. Cover this stuffing with a layer of cotton, letting the cotton stick up far enough to pull over the top of the back rail. Tack the cover to the bottom rail first and proceed in the same manner as you did with the arms, tacking to the back side of the top rail and to the back posts. If the piece has a piped

When pulled tight, the stitch will not show on the surface. After this second band is attached at the top, turn the divan over on its back and place a layer of cotton all the way across under the band. Then pull the cover material down smoothly over this layer of cotton and tack underneath the bottom rail. If there is a finished bottom rail, tack the band to the top of the molding, cover the edge with gimp and fasten either with gimp tacks or antique nails.

When the front bands are finished, cover the seat of the divan with a thin layer of the old filling (hair, moss or fiber), stitching this to the burlap spring cover with three rows of long stitches to hold it in place. After this is done, cover the filling with a layer of cotton as in Fig. 22. Note that the under-cover material is turned back. Draw the under-cover material over the filling evenly and tack to the back and side rails. Do not use too much filling as the seat should always be lower than the front edge, otherwise you will be able to see under the front cushions.

Covering the arms: Put the cushions in place before covering the arms, as these are stuffed out to meet the cushions. Furniture having wide, flat arms such as shown in Fig. 23, should have the edges built up with roll edges to improve the appearance and make the piece more comfortable. Cut the cover material for the arms, using the old pieces for patterns. If new cover material is of a floral design, be sure the de-

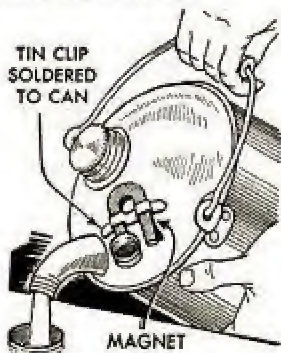
back, it will be stuffed in the manner shown in Fig. 25, stuffing one pipe at a time and hand stitching it to the burlap.

Putting on the outside arm covers: The outside arm covers come next. First, the material is tacked to the rail directly under the arm, Fig. 24, using a cardboard strip to give a straight edge here when the material is drawn down and tacked under the bottom rail. Finally, re-cover the front post panels and nail them on with 1¼-in. brads, cutting the heads off before driving them in as in Fig. 28. Pull the cover material over the headless nails by sticking an upholsterer's pin into the material and lifting.

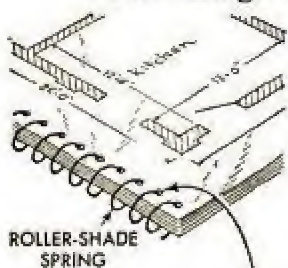
Putting on the outside back: Gimp tacks can be used to apply the outside back cover or it may be blind-sewed, using the same stitch as was used in attaching the second front band. Covering the bottom with cambric completes the job.

Small Magnet Holds Oil Can Caps Conveniently at Hand

You will not be apt to misplace the caps from an oil can when removing them if you solder a metal clip onto the can top to hold a small horseshoe magnet. This provides a convenient place to store the caps where they will always be at hand, even if the can is moved before replacing them. In cases where cans of this type have been used for transporting gasoline, they should be cleaned thoroughly before soldering the magnet holders in place.



Shade Spring Provides Binder For Large Blueprints



HOLES PUNCHED ½" C. TO C.

This is done by punching equally spaced holes along one edge of the sheets and then threading the spring through them by turning it from one end.

—A. E. Ogren, Chicago.

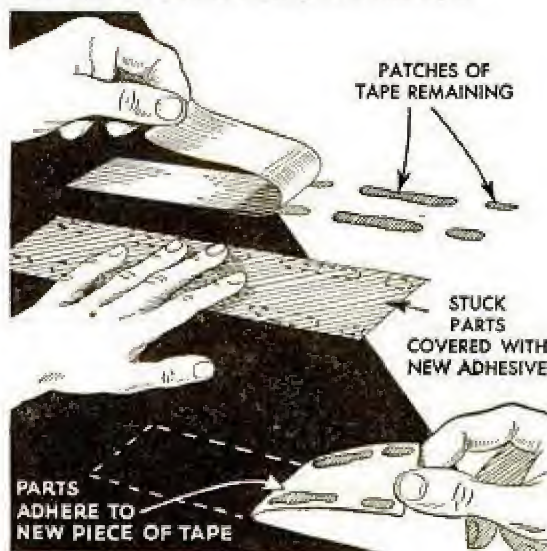
Nail Polish Brushes Are Handy For Children to Paint With



Instead of discarding the small brushes used in bottles of nail polish, save them for the children to use as paintbrushes. They can be washed in turpentine. They are much easier for small children to manipulate than larger brushes, and the little knobs on the ends are easy for small fingers to grip.—Benj. Nielsen, Aurora, Nebr.

Adhesive Left by Masking Tape Removed Easily From Work

Sometimes small patches of the adhesive will remain on the work when masking tape is pulled off. However, if a new strip of tape is pressed adhesive down over the patches they usually will adhere to it and come off when the strip is removed.

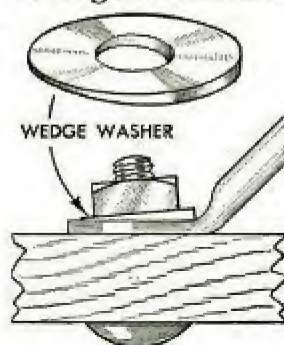


Speedy and Thorough Tool Oiling With This Handy Oiler



To speed up the job of oiling hand tools and, at the same time, make the job less disagreeable, one carpenter carries a handy oiler made from a length of 1-in. tubing or pipe and oiled cotton waste. The tube is packed with oiled waste, and in use, a portion of the waste is pressed out the end of the tube as shown.

Wedge Washer Locks Nut on Bolt



When using a bolt where vibration is likely to loosen the nut and there are no lock washers at hand, make a wedge washer by tapering an ordinary flat washer along one side. When a nut is driven down on the tapered washer, the bolt is twisted slightly to one side so that the threads will hold securely.

Old Clocks Fitted With New Faces By Photographic Process

The difficulty of obtaining new faces for old clocks and the high cost charged by commercial artists to paint special ones, led one jeweler to use his photographic equipment to solve the problem. This was done by removing the hands from a new clock so that a closeup photograph could be taken of the face, after which the nega-

tive thus obtained was used to make enlargements of any size desired. Only a few minutes are required to fit and glue these new faces onto old ones.

—Joseph Farkas, Jr., Chicago.

Tiny Wood Strips Bent Easily Without Steaming

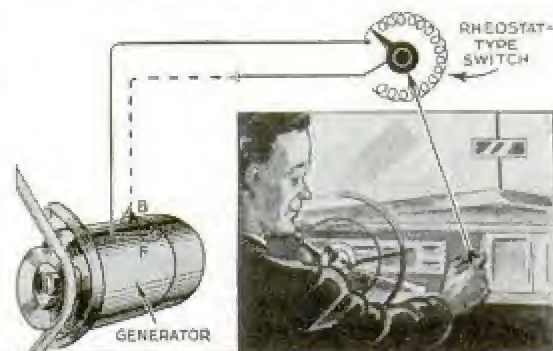
Thin wood strips used in the construction of tiny models often can be bent without steaming if they are scored as shown with a roller wheel made from a binding-post nut such as those used on small dry cells.



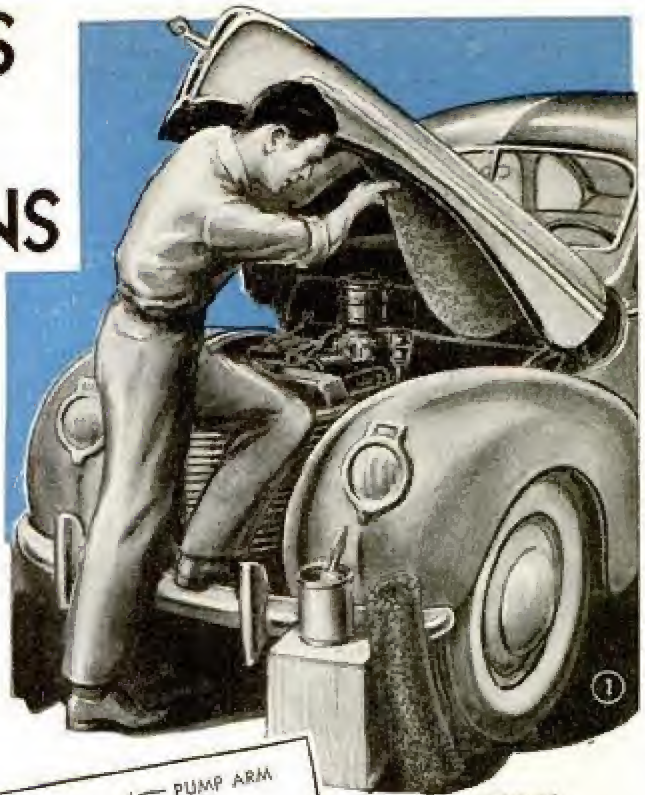
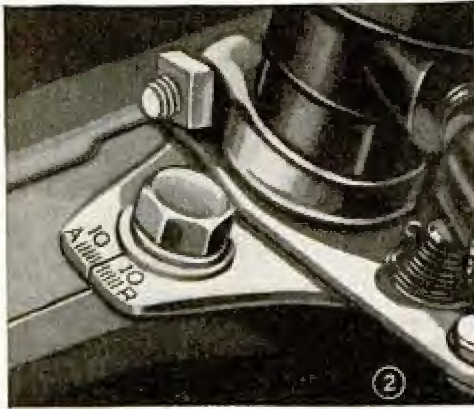
The nut should be slipped over a nail driven into a wooden handle for easy operation.

Output of Generator Controlled By a Heater Switch

If a car is used on short runs where frequent stops are made, voltage and current regulators sometimes reduce the charging rate of the generator too soon. To prevent this and keep the battery more fully charged, a rheostat-type heater switch to control the charging rate manually can be connected to the generator field terminal as shown in the wiring diagram. As most generator field circuits are completed by grounding the field terminal, the switch circuit should be from the field terminal, terminal F in the diagram, to the ground. However, as some generators complete the circuit by connecting the field terminal to the main terminal of the generator, terminal B, it may be necessary to complete the switch circuit by wiring the switch to both generator terminals as indicated by the dotted line. Turning the switch to the "on" position will give maximum output; a setting somewhere between "on" and "off" will give a reduced output.



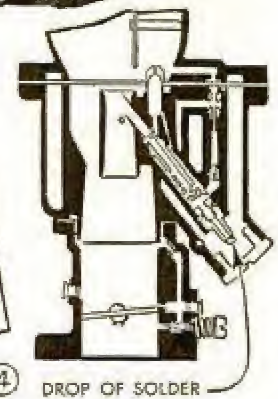
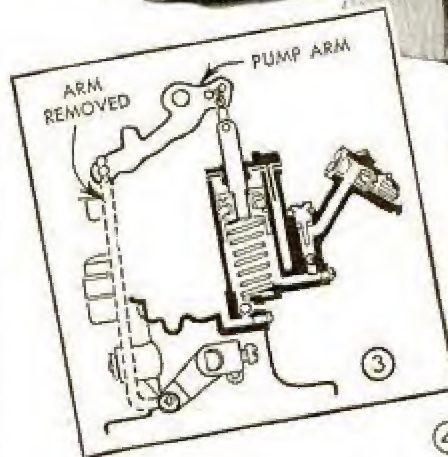
MORE MILES *from your* GAS COUPONS



By C. E. Packer

EVERY motorist realizes that peak performance of his motor plus sane, careful driving are necessary for minimum gas consumption. But, in these days of reduced speeds and mileage, keeping a motor at peak performance may be expensive and the labor shortage now evident in service work may make it impossible to keep your motor at its best. However, there are a number of things that any car owner can do to "stretch" his gasoline coupons. For example, one motorist found that it was an advantage to insulate the inside of the hood and the outside of the crankcase with thick felt building paper as shown in Fig. 1, besides, of course, using a radiator cover, to help keep the motor and oil warm while the car was parked during cold weather.

Adjusting ignition timing so that the motor will "ping" under rapid acceleration is another way that you can get maximum power out of each drop of gas. This is done by advancing the spark, Fig. 2, until you hear a ping when the throttle is opened quickly while traveling at the rate of 15 m.p.h. in high gear with the motor completely warmed to operating temperature. As all modern types of carburetors have three distinct jets that function at different car speeds, closing two of them often results in an appreciable saving of gasoline. There is a low-speed jet, which handles the



car up to speeds ranging from 25 or 30 m.p.h., a high-speed jet that operates at higher speeds, and a power jet located at the bottom of the accelerator well, which functions when accelerating, and also contributes to speed performance. By closing the latter two jets with a drop of solder on each one, Fig. 4, only the low-speed jet is left to function. If this is done, and there is no outlet from the accelerator well, the pump arm must be disconnected as in Fig. 3.

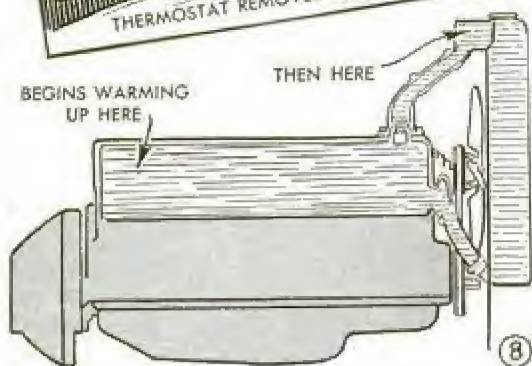
One of the most common causes of lost power and wasted gas is accumulated formations of sludge and carbon in a motor that is not being operated fast enough, far enough, or hot enough to burn them away. Changing the oil filter more frequently than is recommended for normal driving conditions will help to avoid sludge and carbon formations. A filter that is capable of picking up all sludge and foreign matter



⑥



⑦



⑧

will, in addition to reducing engine wear, help to keep the piston rings free in their grooves. When rings stick, considerable gasoline is wasted through "blowby"—gases from the fuel charge passing between the rings and cylinder walls. However, "blowby" may be caused also by the cooling system. Unless this functions correctly, some cylinders may become hotter than others, or the temperature may vary at different locations on the same cylinder. This results in unequal expansion of the metal with consequent rapid wear on the cylinder walls and piston rings, which in turn causes "blowby." The cooling system should be flushed at least twice a year; the

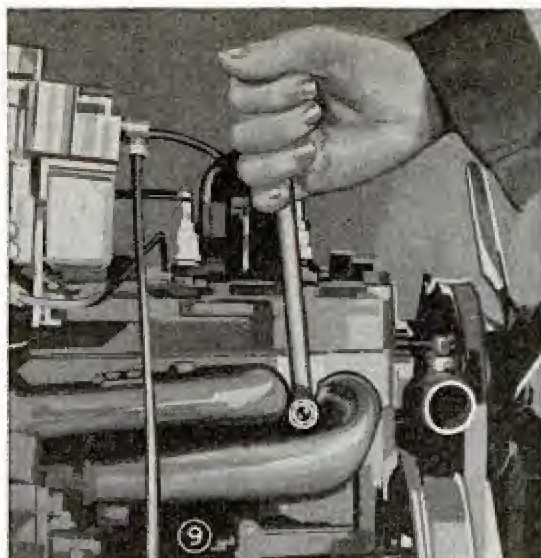


⑤

radiator and motor block being done separately and in the direction opposite to the direction that water circulates in the system as indicated in Figs. 6 and 7. Fig. 5 shows what happens when rust, dirt and grease are allowed to accumulate and harden in the motor block.

The thermostat in the cooling system indirectly affects gas consumption. Its function is to make the motor reach operating temperature as quickly as possible and keep it there. The thermostat does this by preventing circulation of water through the radiator until motor-operating temperature is reached, and thereafter controlling the amount of water that passes into the radiator. A simple check for the thermostat is to feel the block as the motor warms up. Heat should be noticed first at the rear of the block and then at the front as in Fig. 8. However, there should be no indication of heat in the radiator until the block has become reasonably hot. If the radiator warms up at the same time as the rear portion of the motor, the thermostat is faulty. Also, if the radiator shows no sign of warming up even after the block has become hot, the thermostat is not operating, necessitating replacement.

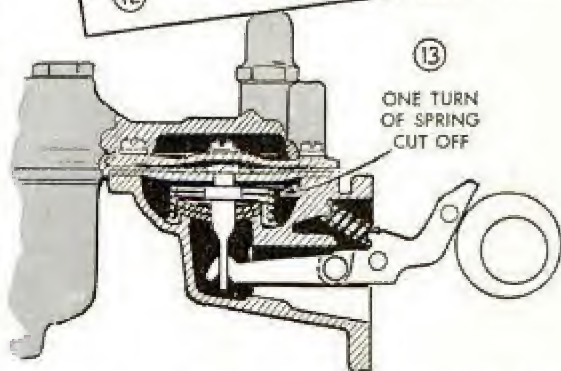
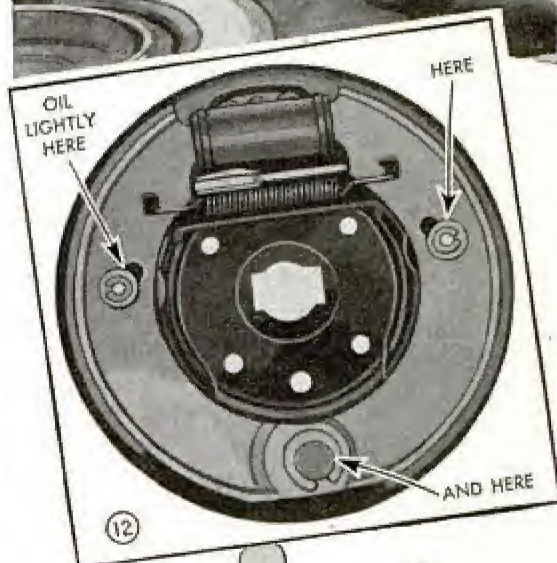
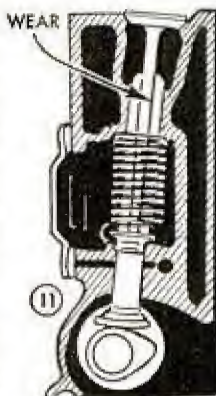
Be sure to keep the motor in good condition so that there will be no necessity for using an excessively rich fuel mixture, as for instance, when air leaks through a loose manifold, Fig. 9, between a carburetor and the base on which it is mounted or along the throttle shaft. These conditions necessitate a rich mixture to keep the motor from dying at slow speed. In such cases repairs should be made so that the carburetor can be adjusted to conserve gasoline. Similarly, worn intake-valve guides are gas wasters. Air enters around the guides, Fig. 11, making it necessary to enrich the fuel mixture. To make matters worse, oil is drawn up around the guides, resulting in excessive carbon formations inside the motor as well as a waste of oil. Carbon reduces the size of combustion chambers and restricts exhaust-gas passages, with the result that there is exces-



sive fuel consumption. This is especially true when the carbon accumulations are in the muffler, tail and exhaust pipes as it is impossible to burn fuel economically in a motor where there is back pressure due to a clogged exhaust pipe.

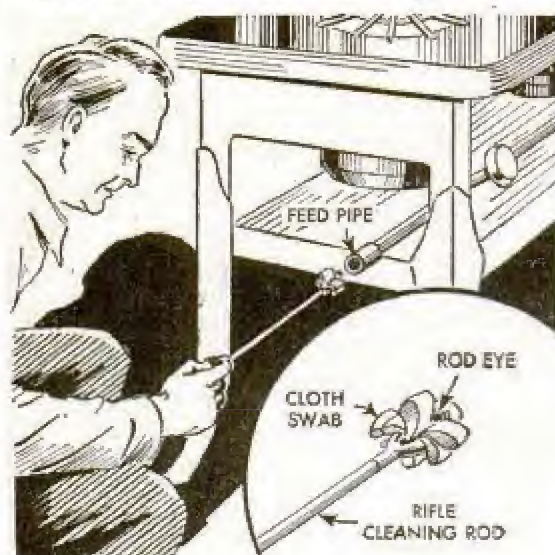
One of the most deceptive causes of lost power, with its resulting fuel waste, is a slipping clutch. A test for this is to drive at 20 m.p.h., then apply the brakes while the accelerator is pressed down. A clutch that holds will slow down the motor as the brakes are applied. Both the clutch pedal and brake pedal should have a free travel of an inch or so; otherwise the clutch may slip or the brakes may drag. It is good practice to remove the brake drums at least once a year and lubricate the moving parts of the brakes as shown in Figs. 10 and 12. And, in connection with the chassis, don't overlook heavy oil in the transmission and differential. Under present-day low speed and mileage, you can safely use light lubricants and thus reduce the lubricant drag on the motor to a minimum.

As a fuel pump is designed for general operation through the entire speed range of the car, it is possible to effect a gas saving by altering the pump when the car is driven at 35 m.p.h. or less. On examining the pump, you will notice that the fuel chamber is loaded by direct force of the cam shaft, but that delivery of gasoline to the carburetor is dependent on a spring pressure against the pump diaphragm. By removing one turn from the spring, as in-



indicated in Fig. 13, fuel pressure is reduced slightly to a point where the gasoline does not surge but will flow with less force into the carburetor. It is this surging of the fuel into the carburetor that causes a sudden rise in float-chamber level, which in turn results in a rich mixture.

Rifle Cleaning Rod Removes Dirt From Kerosene Cooking Stove



If the feed pipe of your kitchen oil stove becomes clogged, you can avoid tipping it or using other cumbersome methods of cleaning the pipe by simply using an ordinary rifle cleaning rod for the purpose. Just put a strip of cloth through the eye of the rod and insert the latter into the pipe to loosen and remove the sediment.

Hanger to Dry Rayon Stockings



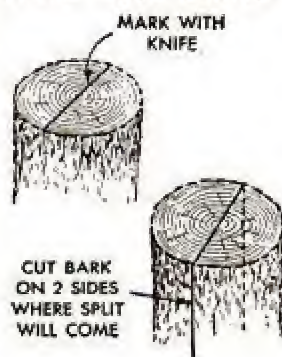
As rayon stockings require from 24 to 48 hrs. to dry, a pair of wire holders like the one shown will spread the tops, which are heavier and take longer to dry, so that the stockings dry uniformly. The hang-

ers can be made from wire coat hangers, bent to the shape indicated.

—Mrs. Carl Forsgren, Seattle, Wash.

Better Success With Tree Grafts

In many cases of unsuccessful cleft grafting of trees I have found that the trouble was due to the bark being torn where the tree stock was split to receive the scion. To avoid this injury, proceed in the usual way, but before



making the split in the center of the tree stock, cut cleanly through the bark on both sides with a sharp knife, making the cuts as far down the stock as the split is to extend. This will cause the bark to part cleanly without tearing when the split is made.—C. S. Marshall, Baptistown, N. J.

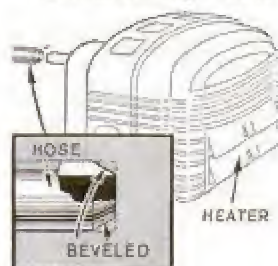
Cup Caster Prevents Creeping Of Washing Machine

Any tendency of a washing machine to creep toward the drain when operating it in the basement, can be prevented by putting a caster cup under one leg of the machine.

The cup should be used under the leg on the high side of the floor. If the cup is put under any of the other legs, there will be a tendency of the high side of the machine to swing around.



Installing Heater Hose Easily

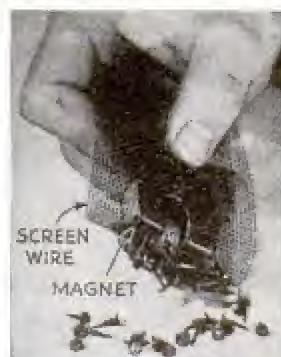


The job of installing an auto-heater hose can be simplified if the ends of the hose are beveled as shown. Beveling allows the end of the hose to stretch so that it can be pushed over the

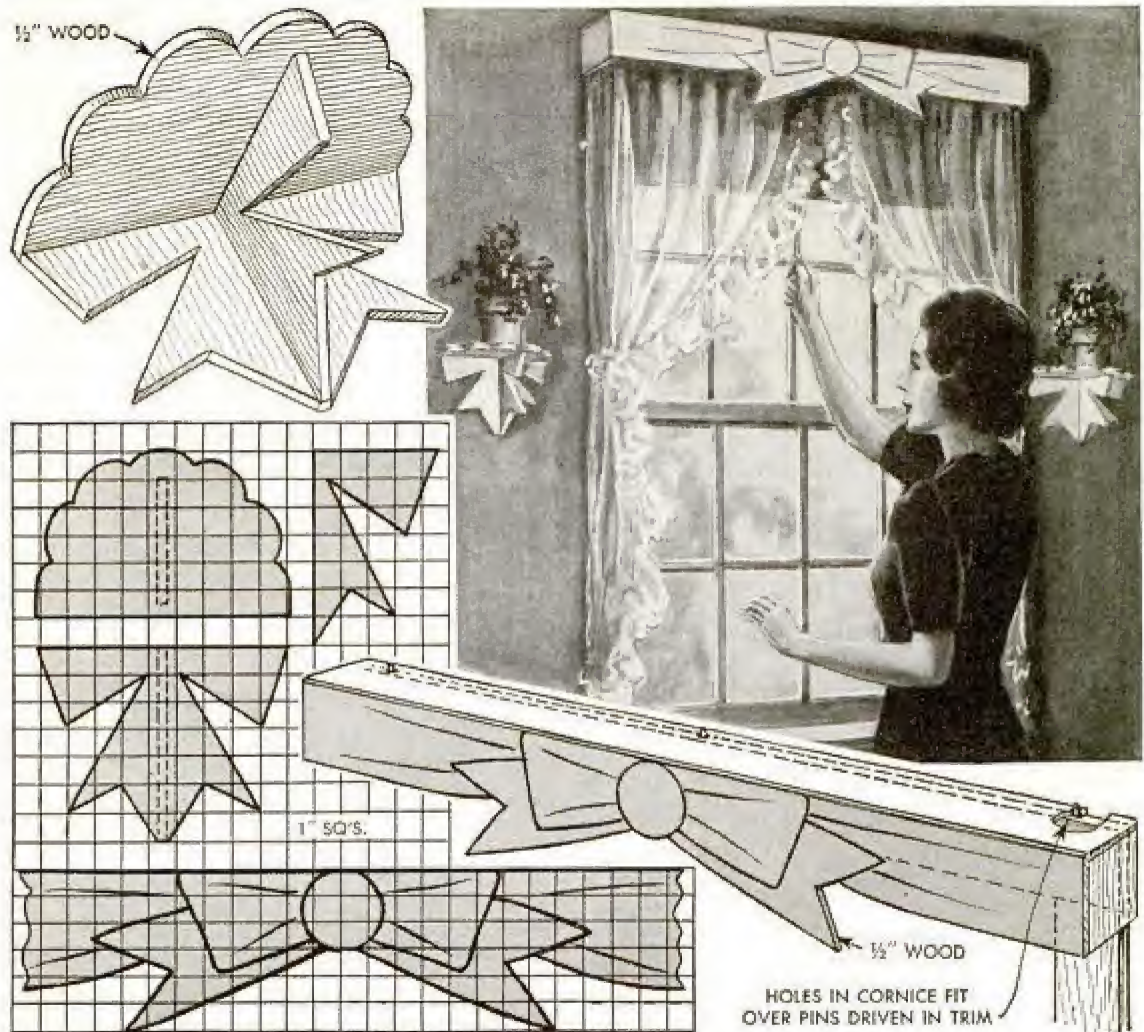
heater connections easily. Being sure that the connections are smooth and free of corrosion also will simplify the job.

Screen Wire Better Than Paper For Magnet Shield

When a sheet of paper is used as a shield to remove tacks, brads and other small articles picked up with a magnet, the paper insulates the magnet so that its strength is somewhat reduced. To overcome this and accomplish the same results, use a folded piece of screen wire instead of paper. The wire will increase the gathering area of the magnet without reducing its strength materially.



"Bowknot" Window Cornice and Wall Brackets



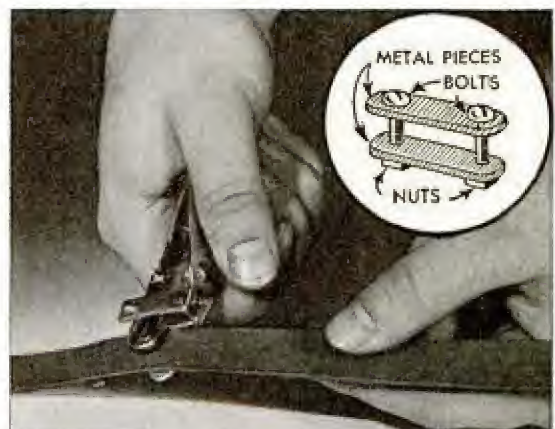
Flanked by matching flower brackets on the wall, this bowknot cornice board is effective in dressing up a window. After making patterns by drawing the designs on paper ruled in 1-in. squares, jigsaw the

cornice board to shape from $\frac{1}{2}$ -in. stock and fit it with endpieces and a top. Outline the bowknot with a paint that contrasts with the finish of the board. Use $\frac{1}{2}$ -in. stock for the wall brackets also.

Hand Punch Fitted With Guide to Space Holes Uniformly

Spacing holes at a uniform distance from the edge of paper, cardboard or leather strips will be a simple matter if your hand punch is fitted with a guide of the type shown. It consists of two metal pieces drilled near the ends to accommodate small bolts, which hold the guide in place after it has been slipped over one of the punch jaws and tightened in the desired position.

❏ If a scrap of paper sticks to your table top or other varnished surface, put a few drops of oil on the paper. Let it stand for several minutes, then rub gently with a soft cloth. This will remove the paper easily without damaging the finished surface.





ANIMAL PHOTOS

By Fred G. Korth



TO BE successful in taking outstanding photographs of birds and animals, you must apply some of the same rules that are necessary in getting good photos of people. Many a photographer takes his shots straight from the shoulder, so to speak, which is a mistake since one of the first requirements in getting good animal photos is to hold the camera down far enough so that the lens will be at or below the eye level of the subject being photographed. To illustrate the importance of this, suppose that you are going out for an unusual photo of a dog, and you find a small, likely subject being taken out on a leash. If you were to hold the camera at a height of about 5 ft. the resulting picture could be entitled "man with dog," but by holding the camera about 5 in. or so above the ground, at or below the eye level of the dog, you would have the opposite effect, and it could be entitled "dog with man." In the first instance the dog would be subordinated but in the latter case the dog would be the center of interest and the man would be subordinated in importance. When taking a picture of a flock of turkeys, a low position of the camera is just as important. On the average turkey farm

where the birds are kept behind a fence, amateur photographers often step up and take a picture of the flock from the top of the fence. The result is similar to Fig. 6, which is not an interesting, effective photo. The way to get a good photo is to hold the camera as low as the grass will permit, being sure that there is no fence wire in front of the lens, and being as close to the flock as is possible, because a closeup photo showing a few birds of the flock is much more effective than a photo of a whole flock taken from a greater distance. The result of such a close-up picture is shown in Fig. 5.

Besides the position of the camera, the photographer must decide whether a closeup study of an animal itself is desired, or whether the photo is to stress the characteristic activity of the animal in its environment. Figs. 1 to 4 inclusive show the first purpose—treating the animals as individuals—while Figs. 5, 7 and 9 illustrate pictures of birds and animals in their natural surroundings. Usually a pet may be taken closeup with a greater degree of isolation than is possible in the case of barnyard animals or wild animals. A little thought concerning the natural instincts, habits and reactions of animals will help to get pictures of unusual interest. For instance, a lost fawn misses its mother, wants to be fed and will suck anybody's finger, which led the photographer to take the photo shown in Fig. 8. In this case the boy was made to



sit down to prevent dwarfing the fawn, which would result if he were standing.

Fig. 1 shows two Scottie pups placed in a basket, which was used for two reasons: to keep the pups from running away and looking in different directions, and also to minimize their size. In addition to this, the basket served to provide contrast against their dark fur. In Fig. 3 a kitten was held

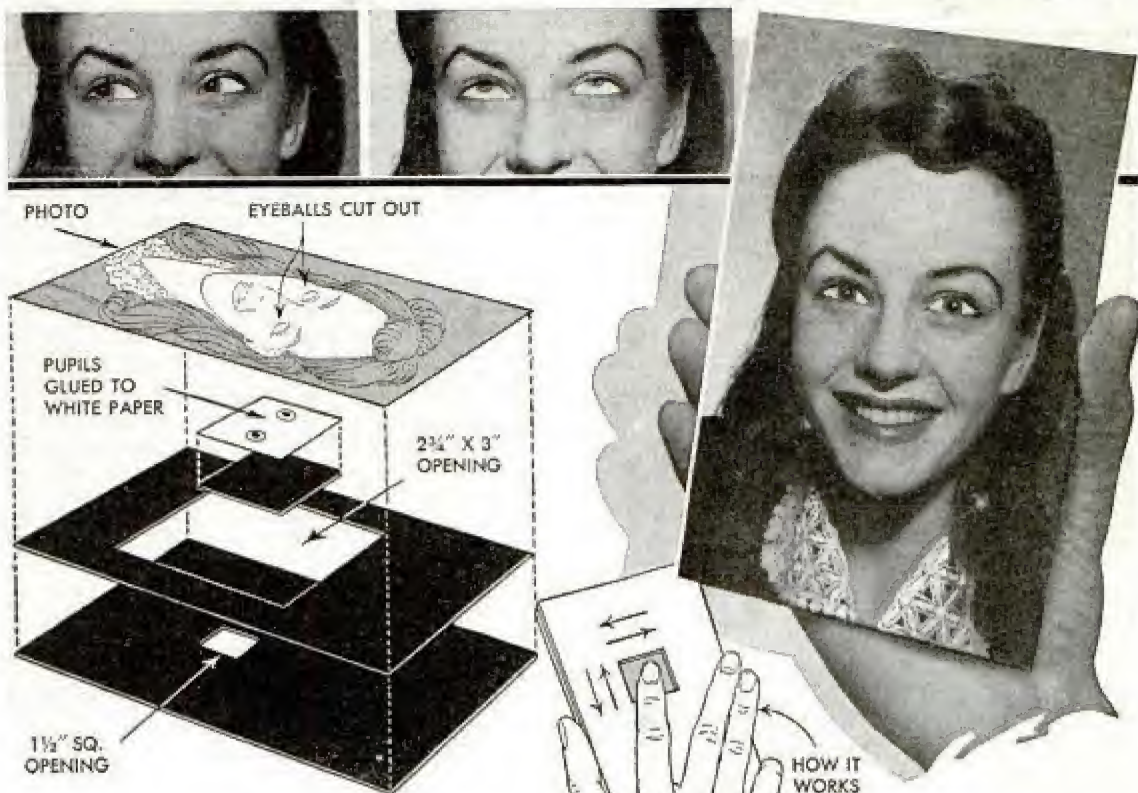




in two hands which gives a clue to its size, brings out the pet angle and also enables the photographer to keep the kitten in focus and in the desired position. Larger animals cannot be confined in this way without introducing the element of restraint. To give them the air of independence they should be photographed without being held or confined unless such angles as their friendliness and devotion to people are to be emphasized. Cats and kittens, left free to run and jump around, are extremely difficult to photograph in interesting poses. Only dogs, generally, can be made to remain in a desired position. In Fig. 9, the hog was lured to assume the position shown momentarily, which gave the photographer an opportunity to shoot the picture. As exposures must be short when taking animal pictures, flash-bulbs, if obtainable, are best to produce highlights and reflections on animals having dark fur, and birds having dark feathers. Photo-flood lamps are next best for illumination if the pictures are taken indoors.



Movable Eyes Change Expression of Portrait



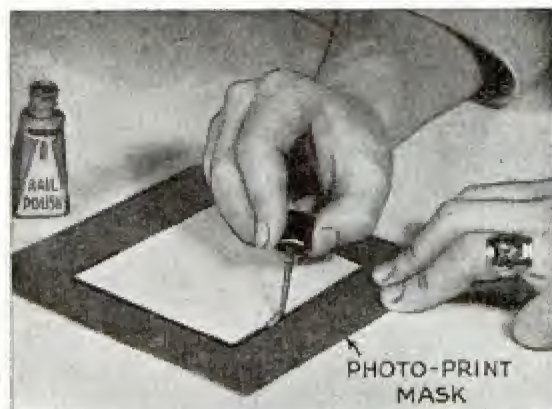
You can have a lot of fun with a portrait by removing the pupils and white portions of the eyes carefully with a razor blade and mounting the pupils on a piece of white or light gray paper glued to cardboard so they can be moved when holding the photo in one hand. The paper to which the pupils are glued should match the sheen of the photo as much as possible, preferably the same paper. The only other materials needed are two pieces of cardboard with openings cut in the center of them as indi-

cated. When glued together, these provide a stiff backing for the photo and they also hold the cardboard on which the pupils are glued in place. After the glue has dried thoroughly, edges of the backing can be trimmed neatly to conceal it. Or, you can improve the appearance of the portrait by fitting it in an attractive frame. The index finger only is required to move the eyes while holding the photo.

Nail Polish Cures Fuzzy Edges of Paper Printing Masks

A little nail polish used on the edges will make a paper printing mask smooth so it

will leave clean, sharp edges on the prints. Draw the polish brush firmly against the edges, in one direction, to press down and anchor any loose fibers.

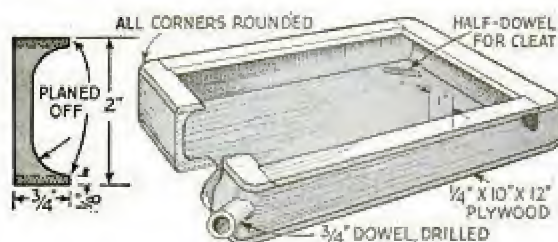


Scoop Improvised From Old Film

Sheets of old film are handy to use as improvised scoops for weighing out chemicals in the darkroom. Two corners of a film are fastened together with a paper clip to form a scoop, which can be used once and discarded or saved for future use.



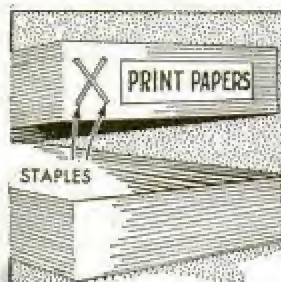
Nonspilling Photographic Tray Made Entirely of Wood



Concave sides that reverse the surge of the liquid and direct it back toward the center, prevent splashing and spilling of solutions while this wooden photographic tray is being rocked. Plywood or hard-pressed board is used for the bottom, while the sides are shaped from $\frac{3}{4}$ -in. solid stock. Plastic glue and nails are used to fasten the parts together. A hollow dowel in one corner, which is plugged with a cork while the tray is in use, makes it easy to pour the solution back into a bottle. Coat the entire tray with waterproof glue mixed to the consistency of thick cream, applying a second coat when the first becomes tacky. A half-dowel cleat tacked to the bottom, diagonally across one corner, keeps prints from sticking to the bottom.

—Edwin M. Love, Monterey Park, Calif.

Print Paper Identified in Dark



Different grades of sensitized paper will be easy to distinguish without turning on a bright light if each box is marked with paper staples. The different boxes can be rec-

ognized instantly by running a finger over the staples, using any simple code, such as one staple for No. 1 paper, two staples for No. 2, and more staples for other grades. Location of the staples on the box can be used to indicate different surfaces.

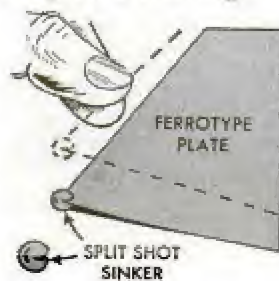
Permanent Titles on Photos

White titles on dark portions of photographs can be made a permanent part of the print by this simple trick. Fill a fountain pen, the "dime-store" variety will do, with hypo and, before exposing the sensitized paper, write any data desired with this pen on the part that will print dark. The hypo fixes the writing so it will not be affected by the subsequent exposure.

—Andrew M. Lavish, Washington, D. C.

Shot Sinkers on Ferrotypes Plates Make Them Easy to Pick Up

To simplify picking up a ferrotypes plate from a flat tabletop, one amateur photographer clinches a split-shot sinker on each corner. The sinkers elevate the corners of the plate so that a fingernail may be inserted under the edge easily. If your plates have sharp corners, the sinkers will cover them and make injury to the hands impossible.



Removing Lint From Photographs

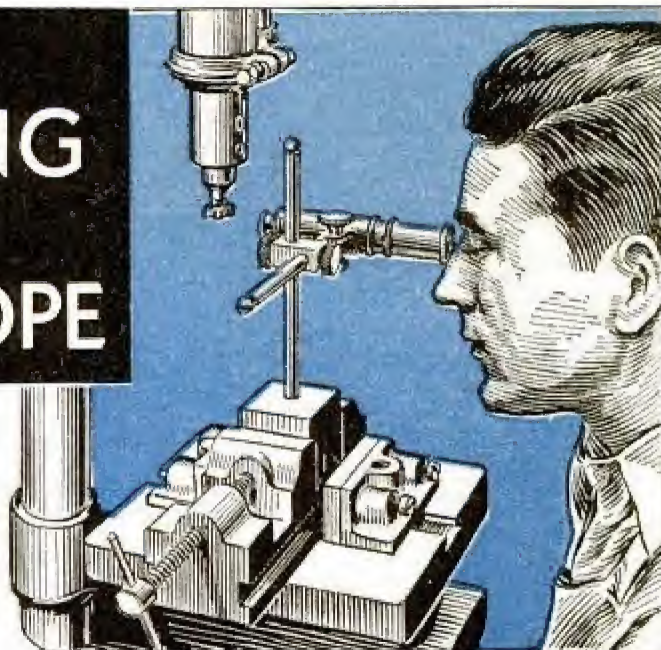
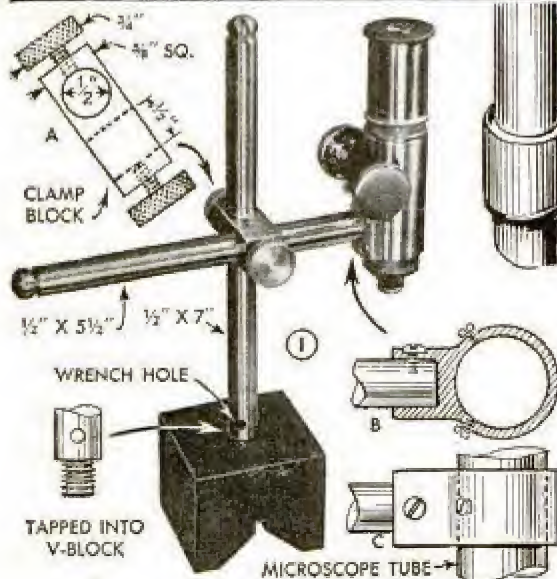
Lint picked up by photos dried between blotters can be removed with cellulose tape. Just place the tacky side of the tape in contact with the portion of the print to be cleaned and when it is drawn away the lint will come with it. The tape may be used repeatedly for the same purpose.





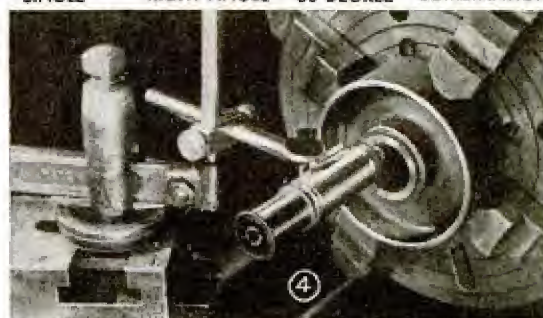
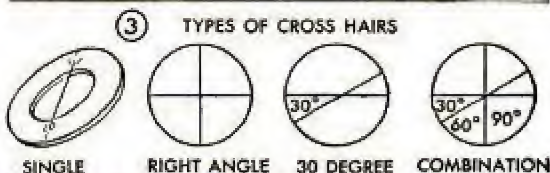
SHOP NOTES

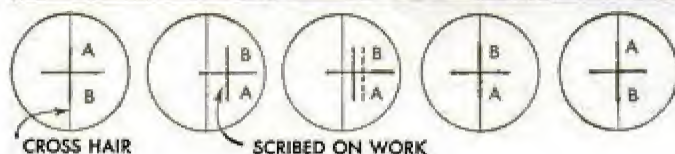
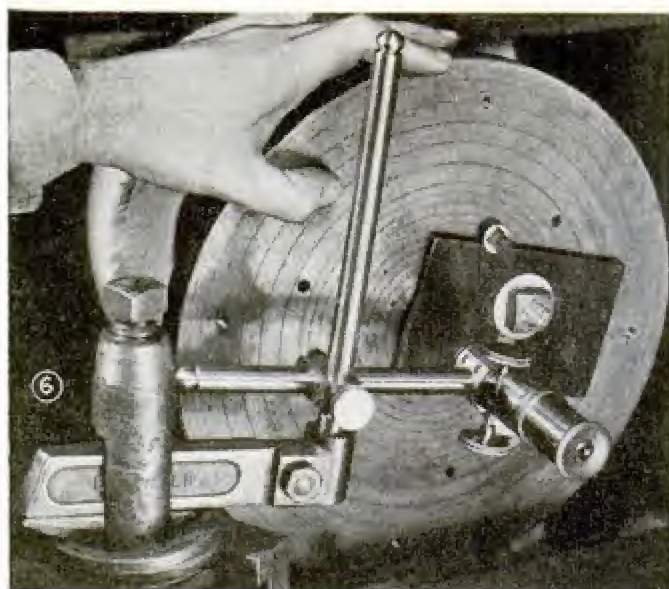
Precision MEASURING with a MICROSCOPE



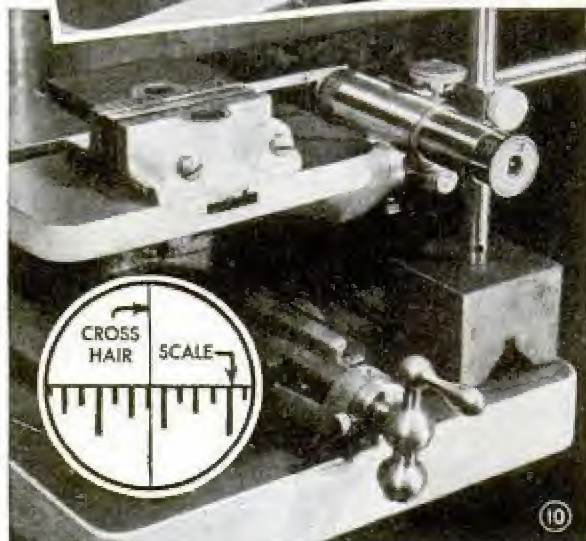
By Walter E. Burton

AS A measuring tool, a compound microscope having a magnification of 20 to 30 diameters can be of great help to the machinist who works to close tolerances. First of all, a stand like the one in Fig. 1 will have to be made to support the lens barrel, and then a cross hair installed in the eyepiece. This may be fine wire or a human hair, although the best material found for the purpose is the silk taken from a spider web. Transferring a strand, preferably from a web recently spun, is done with a cardboard strip notched as shown in Fig. 2, after which the tips are moistened with thin glue and then touched deftly to

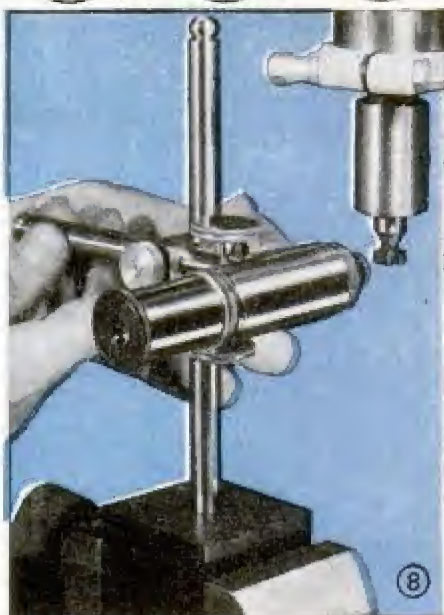
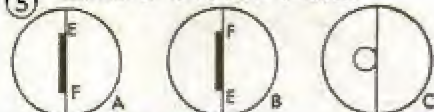




⑦ CENTERING WORK ON LATHE FACEPLATE

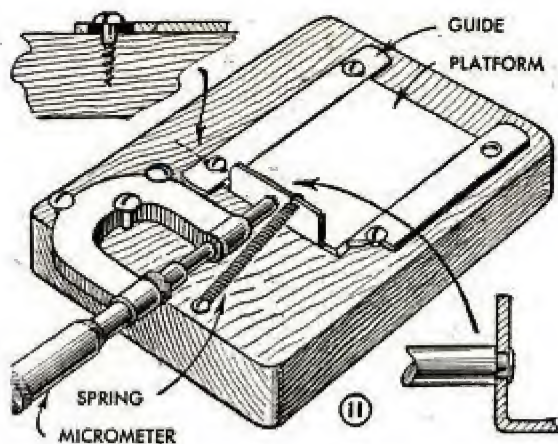


⑤ CENTERING WIDE LINE OR CIRCLE



the spider web. Now, two dabs of glue are applied to the washer-like diaphragm of the eyepiece, diametrically opposite each other, after which the cardboard is touched to these spots to transfer the strand. A single cross hair will do in most cases, although two or more may be used as indicated in Fig. 3.

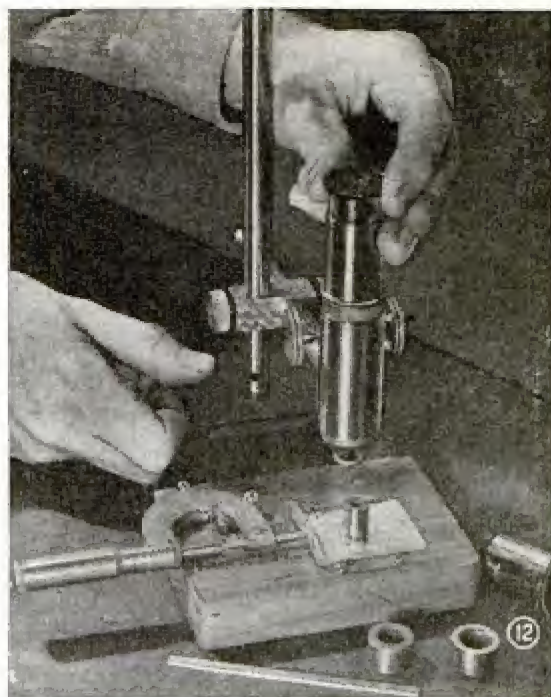
Now for the jobs to which this instrument can be applied: Centering work on a faceplate is one. Here the work is scribed with fine cross lines in the usual way, after which it is mounted on the faceplate. Now, with the lathe running, and the microscope supported by the tool post as in Fig. 6, you sight through the eyepiece and focus the lens on the approximate center of rotation. Next, the lathe is stopped and the eyepiece is adjusted so that the cross hair will be in a vertical position and parallel to one of the cross lines on the work as shown in the first detail in Fig. 7. If one is not over the other, the work is shifted accordingly. Now, the faceplate is rotated 180 degrees so that scribed line A-B will be upside down as shown in the second detail of Fig. 7. In most cases the scribed line will be on one side or the other of the cross hair. The space between the two represents the amount the work and microscope are off center. This is corrected by carefully moving the work sidewise until the space is reduced one half as shown in the third detail. With this done, the cross hair is



brought directly over line A-B as shown in the fourth detail. If the cross hair and the line coincide, when the faceplate is turned another 180 degrees, you will have the work centered in one direction. You go about centering the horizontal line in the same way, and when both the horizontal and the vertical lines remain in alignment with the cross hair as in the fifth detail, the work is centered. Where a hole, a button or a wide line is being centered, the cross hair is aligned with one edge as shown in the detail A, Fig. 5. Note in details B and C that the cross hair remains on the same side of the mark when the faceplate has been rotated 180 degrees.

Centering a pulley in a four-jaw chuck, Fig. 4, is another use where the microscope will be of help. Here the pulley is chucked and then a light cut is taken across its hub to brighten the metal. With the microscope supported as before, and focused on the hub, the lathe cross-feed and the eyepiece are adjusted simultaneously to bring the cross hair tangent to the edge of the hole in the hub. When it is noted through the microscope that the cross hair remains tangent to the edge of the hole during one complete revolution of the work, the pulley will be centered in the chuck.

Calculating beforehand the size hole a fly cutter will bore is another job made easy with a microscope. To do this, the microscope is set on the machine table or clamped in the work vise as in Fig. 9. Then it is focused on the tip of the cutter and the table is adjusted crosswise until the cross hair lines up exactly with the edge of the cutter. Now, a reading is taken of the table feed-screw scale, after which the spindle holding the cutter is rotated 180 degrees to move the cutter around to the opposite side. Next, the table is advanced, being careful not to disturb the microscope, until the point is reached where the cross hair is once more in line with the tip of the cutter. Finally, a second reading is made of the feed screw to determine the distance traveled by the table which equals the di-

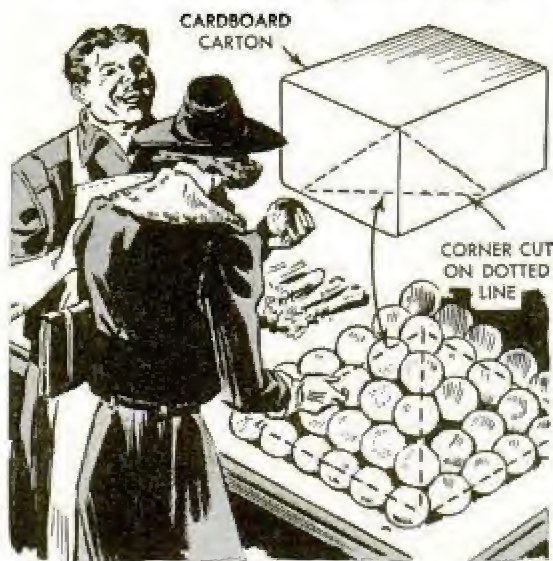


ameter of the hole that the cutter will make. A similar set-up, Fig. 8, can be used to determine whether a milling cutter is running true by simply sighting through the eyepiece and seeing if each tooth aligns with the cross hair. The magnification also will enable you to note whether the degree of bevel on each tooth is the same.

Cross-feed screws in tables of milling and boring machines can be checked quickly for wear with a set-up similar to the one shown in Fig. 10, which in this particular case shows a micrometer drill-press table being tested. A steel scale or ruler is clamped in the work vise and the microscope is placed on a stationary part of the machine. Then the cross hair is lined up with one edge of a graduation on the scale as indicated in the circular detail in Fig. 10. At this point, a reading is taken of the graduated scale on the cross-feed screw, after which the table is advanced until the cross hair has traveled one or more divisions on the steel scale, stopping it on the same side of the graduation as in the first setting. A second reading is taken of the feed screw and the amount it has moved is compared with the distance traveled on the scale. Thus, if you moved the cross hair across the steel scale $\frac{1}{2}$ in., the feed-screw scale should read 0.0313 in.

Figs. 11 and 12 show how a measuring device can be rigged up and used with the microscope to check the diameter of beveled holes in bushings. It consists of a sliding metal plate, the movement of which is controlled by a 1-in. micrometer, which has the anvil removed to permit insertion of a short rod to move the plate.

Corners From Cardboard Carton Make Pyramid Fruit Display



To make neat and uniform displays of fruit on the counter or in the display window, one clerk uses corner sections cut from cardboard cartons. These not only serve as shaping foundations, but also permit the pyramids to be built with smaller quantities of fruit and still make an attractive display.

Wrist Pin Dresses Grinding Wheel

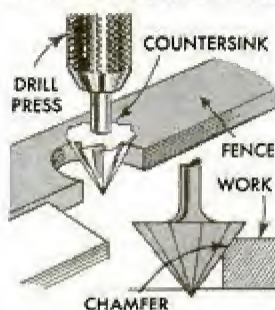


In the absence of a suitable grinding-wheel dresser, you can use an old auto wrist pin. A handle for the pin can be made from a length of small rod as shown. Be sure that the rod is of small enough

diameter to permit the pin to rotate freely on it.—Robert Hill, Sugarland, Tex.

Chamfering With a Countersink

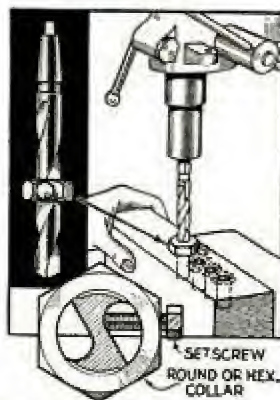
When there is no tool at hand for chamfering soft metals, plastics or wood, you can do a good job by using a countersink bit in a drill press. It will be necessary to make a fence and clamp it to the drill-press table to guide the work along the edge of the countersink bit. The fence can be made



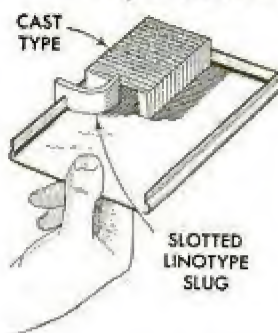
of wood as shown. For best results, the bit must be honed to razor sharpness, and should be rotated at the highest speed of the drill press.

Simple Depth Stop for Drills

This drill depth stop is easy to make and handy to use. Disks cut from round or hexagon stock and drilled to form collars can be used or you can ream out hexagon nuts to suit. A setscrew in one side of the collar locks it on the drill.



Cast Type Held in Galley Securely By Bent Linotype Slug



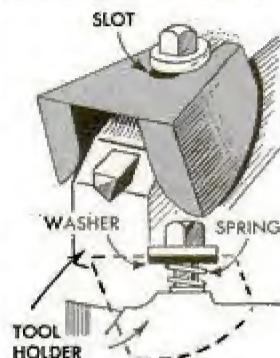
Instead of using weights to keep cast type in position in a galley, one printer uses linotype slugs. These are bent in an L-shape and notched near one end to slip over the side of the galley. When pushed tightly against the

type, the slotted slug wedges against the galley side and holds tightly, yet is easy to loosen when desired.

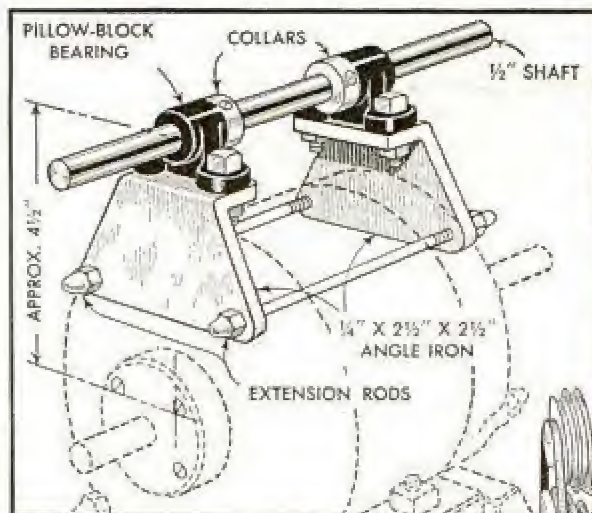
Shield Keeps Chips From Flying When Turning Brass or Bronze

To prevent chips from flying about when turning brass or bronze, I use a shield on the turning-tool holder like the one illustrated. The top portion of the shield, which is made from sheet metal, is slotted to straddle the bolt that locks the tool in the holder. The shield is held between two washers, which are forced tightly against the bolt head by means of a coil spring as indicated in the lower detail.

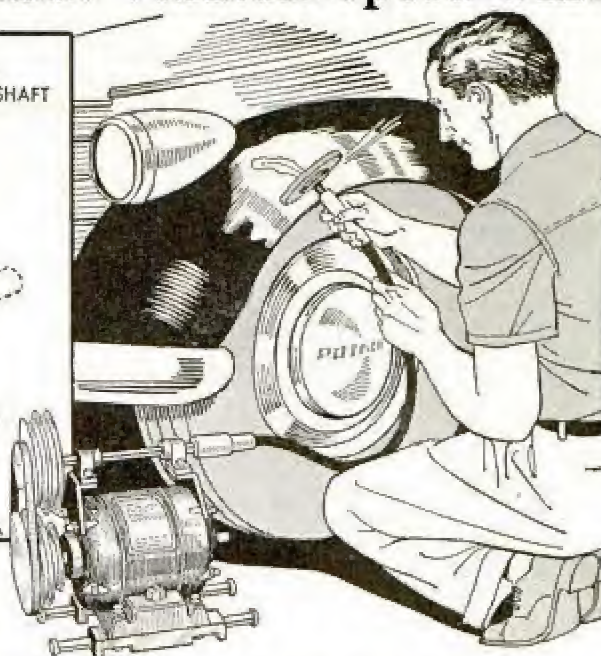
—D. E. McDonald, New York City.



Jackshaft on Motor Makes Variable-Speed Unit



You will find many uses for this compact motor-and-countershaft unit, which consists of a jackshaft mounted on an electric motor. The unit can be fastened in a fixed position for driving power tools, such as metal-turning lathes, drill presses, etc., where various speeds are required, or it can be carried about for operating a flexible shaft as shown. By using two 5-in. cone pulleys and a motor of 1,750 r.p.m. on the original unit a speed range of 700 to 4,375 r.p.m. was obtained.



Pillow blocks serve as bearings for the shaft, and they are bolted to angle-iron supports, which are attached to the motor by placing them under the nuts of the tie rods that hold the motor housing together. In some cases, it may be necessary to substitute longer tie rods for the original ones.

—Kent H. Alverson, Niagara Falls, N. Y.

Printer's Make-Ready Paste Dispensed From Grease Cup

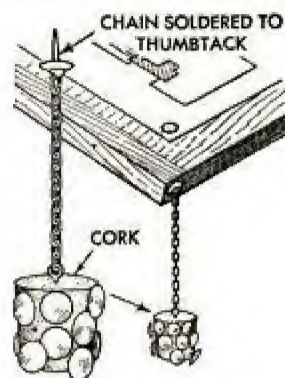
To save the time spent in opening and closing a jar or can of make-ready paste, when preparing a run on his job press, one printer attached a grease cup of the type that has a screw cover to the underside of the feedboard. The cover was fastened to the board with a couple of screws so that

it could not turn, after which the cup was filled with paste and screwed into it. A slight turn of the cup releases the desired quantity of paste, and refilling is necessary only at long intervals.



Cork Serves as Thumbtack Holder At Artist's Drawing Board

Artists and others who use thumbtacks for holding sheets of paper on drawing boards will find that a large cork makes an excellent holder for the tacks. The cork is fitted with a short chain to which a thumbtack is soldered to permit attaching the holder near one corner of the drawing board as shown. The cork cannot roll out of reach and it is always at hand.



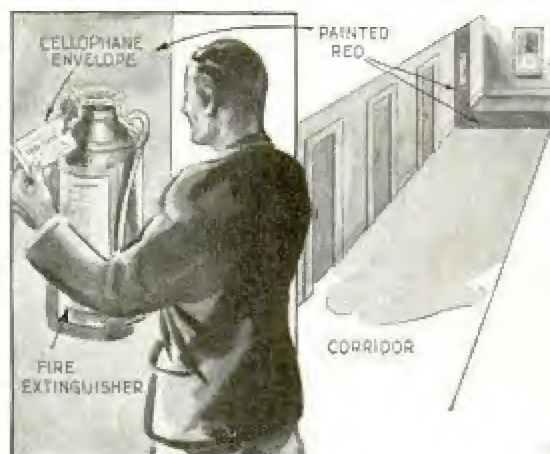
Button Pockets on Nail Apron Are Easy to Empty



Instead of digging into the pockets of his apron to empty them of nails and staples, one carpenter buttons the pockets on the apron so that they can be emptied easily as indicated. To do this, the pockets are made separately and then the lower edge is sewed to the apron and the upper edge is buttoned to it. Thus the pockets may be opened and dropped down to empty the contents without removing the apron. This also keeps them free of dust and shavings.

Fire Extinguisher Spotted Quickly By Painting Red Band on Wall

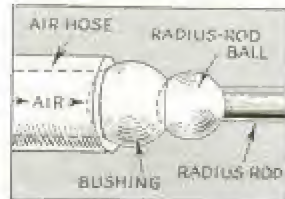
For quickly locating fire extinguishers in large buildings, it's a good idea to paint a wide red band on the wall and floor at the location of each extinguisher. In this way, such fire-fighting equipment can be rushed to the scene without loss of time, as only a glance down a long corridor is needed to spot the extinguisher intended



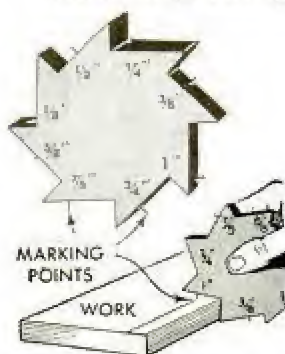
for use in that vicinity of the building. Also, where extinguishers are kept in factories, dust and grease often collect on the tags containing information about recharging, making the data difficult to read. This trouble is overcome easily by slipping the tags inside Cellophane envelopes, as shown.

Bushings Put on Ford Radius Rods With Aid of Air Hose

Difficulty in forcing rubber bushings over the ball ends of Ford radius rods can be overcome by using an air hose to do the job. First, wet the bushing with water, which serves as a lubricant, and then hold it against the ball. Place the air hose behind the ball and turn on the air. This will expand the bushing so that by pushing against it with the hose it will slide into place easily. Of course, the inside diameter of the hose must be smaller than the outside diameter of the bushing so the latter will not slip into the hose.



Marking Gauge Saves Time



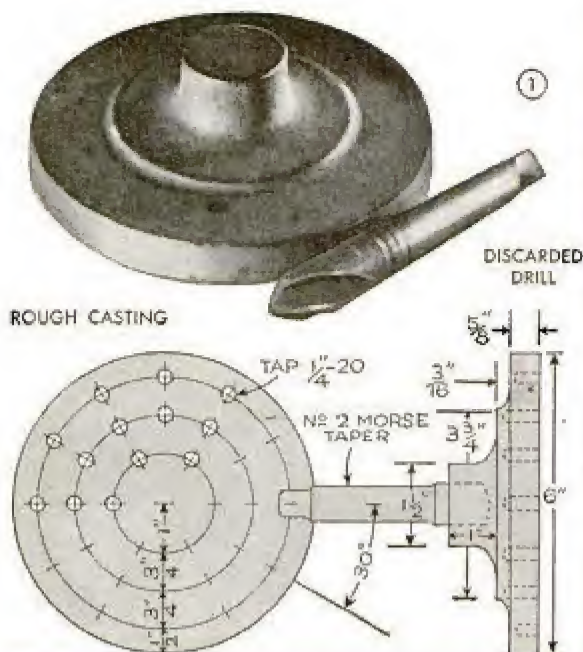
If you often have to use a marking gauge and the distance of the scored line from the edge of the work varies from $\frac{1}{8}$ in. to 1 in., this multiple gauge will save time as it has eight fixed score points calibrated in eighths of an inch.

The gauge is made from a disk of hardwood as indicated. Nails having their heads cut off and driven into the disk at the desired locations serve as the scoring points.

Sandblasting Distributor Contacts Increases Ignition Efficiency

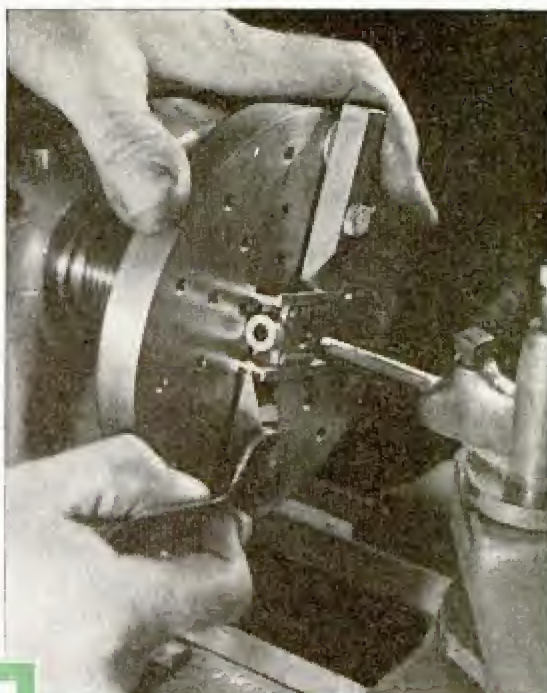
Resistance in the secondary circuit that interferes with the spark and cuts down engine efficiency can be removed quickly with the aid of conventional spark-plug cleaning equipment. This is done by using one of the small spark-plug adapters to sandblast the distributor terminals until thoroughly clean, as resistance, in the form of corrosion, usually develops at contacts in the distributor cap.

—C. E. Packer, Chicago.



Making a Taper-Shank FACEPLATE

WORKING from soft gray-iron castings, there are a number of machine-tool accessories that can be made in any small machine shop. A good example is this taper-shank faceplate, which has tapped holes in its face for attachment of dogs that hold small work securely for machining as in Fig. 2. Its shank is a discarded taper-shank twist drill that matches the hole in the headstock spindle, enabling the operator to slip it in or out of the spindle quickly.



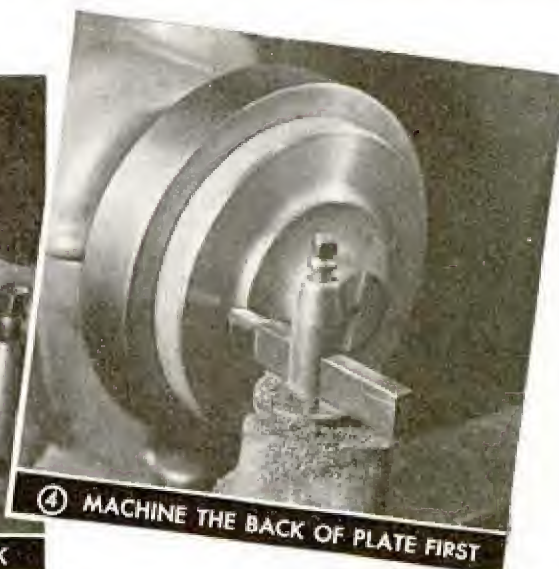
② METHOD OF MOUNTING SMALL WORK



③ CUT OFF DRILL FLUTES FROM SHANK



⑤ TEST ARBOR HOLE FOR DRIVE FIT ON SHANK



④ MACHINE THE BACK OF PLATE FIRST

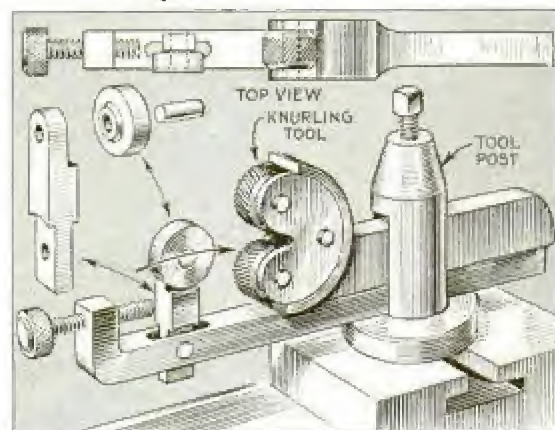


From the picture of the rough casting shown in Fig. 1, you can get an idea of what the wooden pattern for it should look like. It is turned of white pine, and should be made a little larger than the finished size in the drawing to allow for centering and machining. Several coats of shellac should be applied to seal the wood before handing it over to the foundry.

With the casting at hand, the first step is to place the taper-shank drill in the lathe spindle and cut off the fluted portion as shown in Fig. 3. In most cases, this can be done easily without annealing it, as the hardening usually does not extend beyond the flutes. At the end, for a distance of about 1 in., the taper is machined straight to form a suitable tenon for forcing into the casting. Three or four short bolts are used to attach the casting to the lathe faceplate, as in Fig. 4, the bolts being inserted through the faceplate from the back to engage blind holes drilled and tapped in the casting. These holes are located equidistantly on a 5-in. circle as in Fig. 1. The other holes are

drilled after the casting has been faced. The back of the casting is machined first, using a round-nose tool, after which it is drilled and bored slightly undersize to provide a drive fit on the drill shank as in Fig. 5. Lacking an arbor press, you can make use of a large vise to force the shank into the casting, or you can drive it in place with a heavy hammer and a wooden block. Next the shank with casting attached is slipped into the headstock spindle, after which the edge and face of the casting are machined as shown in Fig. 6. This procedure assures that the faceplate will run true. Before removing it from the spindle, locate the other holes, spacing them according to Fig. 1. Center-punch each mark carefully and complete the job by drilling with a No. 7 drill and tapping with a $\frac{1}{4}$ -20 tap. In tapping the blind holes, a bottoming-type tap must be used. As a precaution against breaking the tap, go slowly when reaching the bottom of the hole and, when the tap begins to turn hard, stop and back it away.

Back Rest Rides With Knurling Tool to Steady Long Work

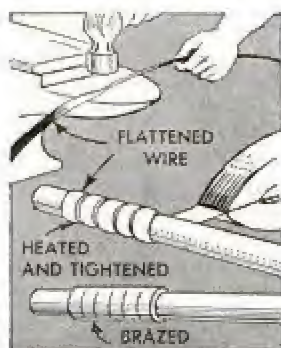


Rod stock and similar slender work to be knurled in a lathe can be kept from chattering and springing away from the tool if this simple back rest is used. It is slipped under the knurling tool in the tool post, and consists of a length of bar stock, bent L-shape, slotted and fitted with a pivoted arm holding a hardened roller, which is brought to bear against the work by means of a thumbscrew. Traveling slightly ahead of the knurling wheels, the roller cannot mar the knurled work, and as the back rest is clamped to the tool, it gives constant support. The same idea can be used also when turning slender work.

—Everett McDonald, Denver, Colo.

Increasing Diameter of a Shaft

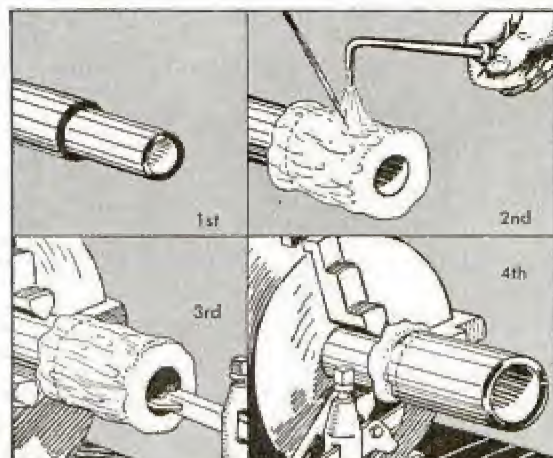
Here is an easy way to build up the diameter of a shaft where suitable equipment for the work is not at hand. In fact,



the work can be done in a blacksmith's forge. First, flatten a length of wire, the size of which is determined by the amount the diameter of the shaft is to be increased, and wrap it tightly around the shaft, spacing the wrappings as closely as possible.

Then heat the shaft and wire and pull the latter up tightly. Next, cover the wire by welding, being sure that the molten metal runs in between the turns of wire. If the work is to be done in a forge, heat the wire and rod to a bright red color and then apply brazing flux and melt the brazing rod by rubbing it over the red-hot wire. If a hard surface on the shaft is desired, use cast steel or spring wire. After building up the shaft, turn it down in a lathe to the desired diameter.

How to Make a Bronze Bushing



If a bronze bushing is needed and there is no stock at hand for turning one, you can do the job with a welding torch. First select a piece of steel tubing that has an outside diameter slightly smaller than the required inside diameter of the desired bushing. Then, with a torch and bronze welding rod, build up a collar on the turned end of the tubing, making it a little larger both in diameter and length than that required for the bushing. Now, bore out the collar to the desired size, making sure all the steel has been removed. Next, turn down the outside to the required size.

Carton Flaps Held for Packing By Stops in Bench



Annoyed by having the end and side flaps of cardboard cartons get in his way when filling them for shipment, one clerk drilled holes through the bench top for the insertion of wooden dowels. These are spaced to accommodate the various sizes of cartons employed, and may be driven up to hold the carton flaps.

Tool-Handle Ferrule Made Easily From Base of Spark Plug

Tool-handle ferrules that are strong and really "stay put" can be made from the bases of certain types of spark plugs. First, dismantle the plug and turn the base onto the end of the handle so that the threads cut into the wood. Then chuck the assembly into a lathe and turn down the base, removing the shoulder and the knurled surface. Then polish the turned surface with emery cloth and saw off the base flush with the end of the handle.



Using a



By H. J. Chamberland

SURFACE-GRINDING machines were once limited in size and only adapted to finishing small parts, particularly in tool-room work, but a modern surface grinder such as the one shown in Fig. 1, has a greatly increased range of application. Some of the larger models have a work capacity as much as 16 ft. in length. Surface grinders vary in design. Some are equipped with vertical spindles, are fitted with cylinder-like or cup grinding wheels, and have tables that either move transversely or rotate. Other surface grinders have horizontal spindles fitted with large straight wheels and have rotating tables only, while still others have horizontal spindles and tables which move transversely. The latter type of machine, which is used most gen-

erally, has the widest range of applications for machine-tool construction as well as precision tool work, and it is the only type of surface grinder capable of producing irregular and plain surfaces in a single work set-up.

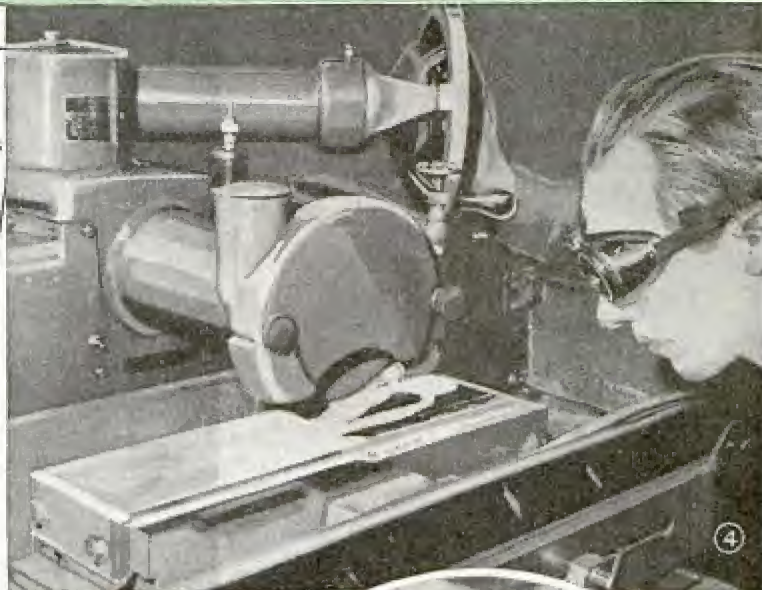
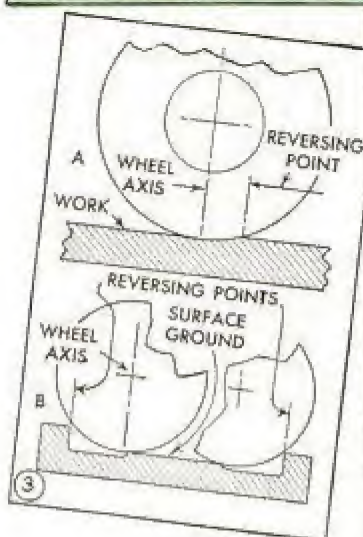
What the machine does:

A modern surface grinder of the horizontal-spindle type and traverse table movement must meet four requirements, often simultaneously if the nature of the work demands it. These requirements are accuracy of size, accuracy of flatness, accuracy of parallelism and accuracy of finish. While accuracy may vary .0005 in. on large machines, it is often as close as .00005 in. on tool-room surface grinders. Size, flatness and parallelism represent surface accuracy. Finish accuracy is controlled by the effectiveness of the grinding wheel, and also by the amount of feed—vertical, longitudinal and cross-feed. The small casting shown in Fig. 2, which is being surface-ground, is apparently of a nature to disregard size and parallelism; accuracy of flatness is the objective here as the surface must be mated to a similar one. In this case, the finish is also of secondary importance provided a perfect joint results. On the other

hand, the surfacing operation shown in Fig. 4 is that of grinding simultaneously thirty-six gage blocks—a set-up demanding four-point accuracy. Accuracy of size depends on accuracy of flatness and accuracy of parallelism. The finish must also have that degree of fineness which safeguards lapping results.

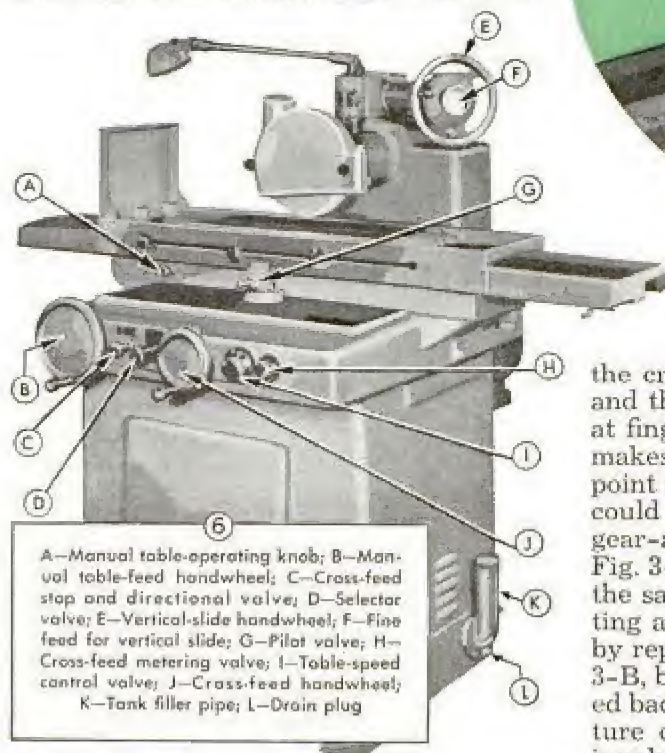
Surface-grinding machines produce surfaces of such precision that more than 75 percent of the former scraping operations have been made unnecessary, and the work of lapping is greatly simplified. However, even a precision surface-grinding operation is not accurate enough to mate the sliding members of a grinding machine. Therefore, after castings for surface grinders are aged to relieve them of internal strains, they are machined accurately and hand-scraped carefully, as shown in Fig. 5.

SURFACE GRINDER • • •

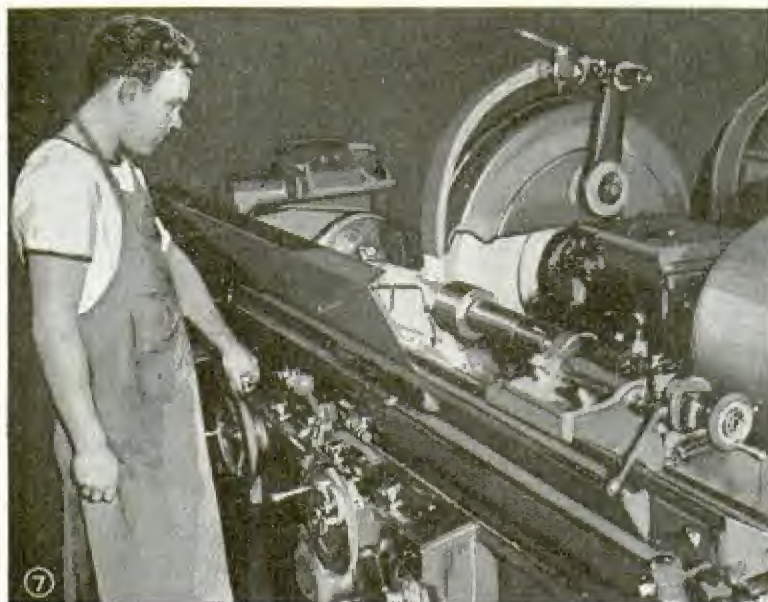


All cylindrical members are precision ground and lapped to produce a unit of absolute rigidity that will be free from vibration.

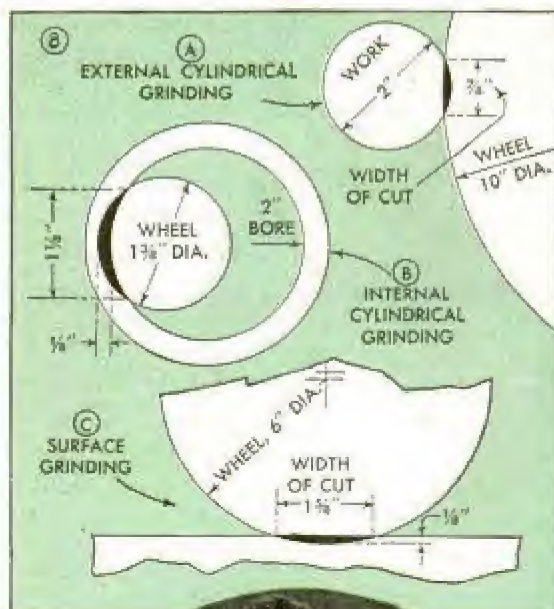
Easy to operate: Surface grinders of the horizontal-spindle type, regardless of size, embody the controls shown in Fig. 6. The hand-operated vertical slide feeds downward and is fitted with a directly driven, ball-bearing spindle. The hand-wheel permits making adjustments of



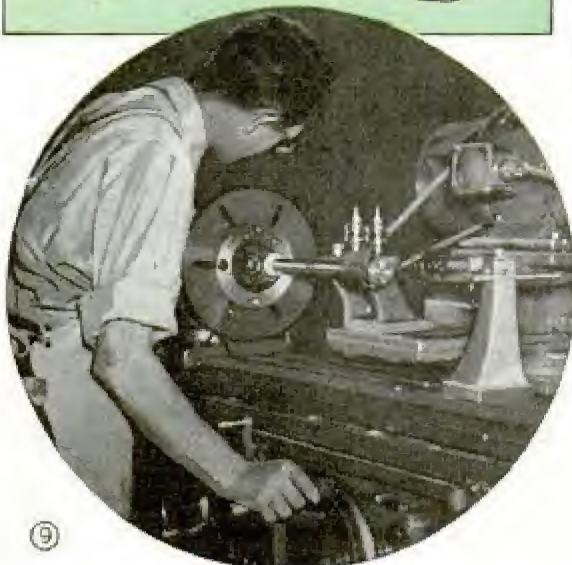
.0001 in. if necessary. The longitudinal movement of the table can be controlled by hand or hydraulically, which is also the case with the cross-feed. The amount of cross-feed and the rate of the longitudinal speed are at finger-tip control. Hydraulic operation makes it possible to limit the reversing point of the table within a hair line, which could never be done on a machine with gear-and-pinion operation. As shown in Fig. 3-A, the table must reverse exactly at the same point with each pass, or the cutting action of the wheel will be destroyed by repeatedly hitting the shoulder. In Fig. 3-B, both wheel and work would be affected badly by uneven reversal due to the nature of the particular grinding operation involved.



Area of contact: The grinding wheel is a cutting tool that differs from cutting tools made of metal in that thousands of small cutting edges do the work rather than one or a few. The correct grinding wheel and a dependable spindle represent the heart of a grinding machine. In all grinding operations, the area of contact where wheel meets work, is a decisive factor in wheel selection. The amount of contact area is as important a factor in choosing the proper grade of wheel for a job as the material to be ground. External cylindrical grinding, Fig. 7, differs



from internal cylindrical grinding, Fig. 9, and also from regular surface grinding in respect to area of contact. With external cylindrical work as shown in Fig. 8-A, the contact area is at a minimum regardless of the ratio between the diameter of the wheel and that of the work. With internal cylindrical grinding as in detail B, the area of contact is by far greater than is the case in detail A, even with the smallest practical diameter of wheel in relation to the diameter of the bore. For efficient cutting, the wheel must be softer for internal grinding than for external grinding, as the area of contact is greater. Wheels used for internal work are usually two grades softer than those used for external grinding. In surface grinding, the area of contact might appear to be less than it is in internal cylindrical grinding but this is not the case generally. See detail C of Fig. 8. The work surface is straight and the wheel diameter is seldom less than 6 in., although it may be as much as 12 or 14 in. on large surface grinders. Therefore, the area of contact in

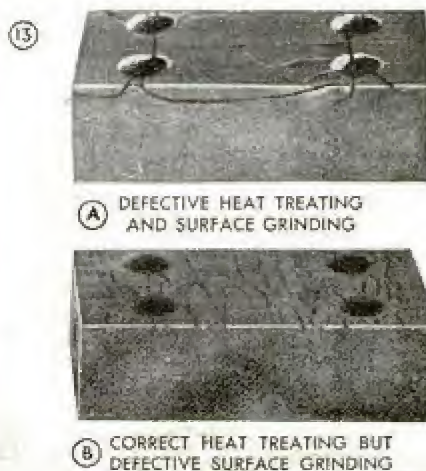
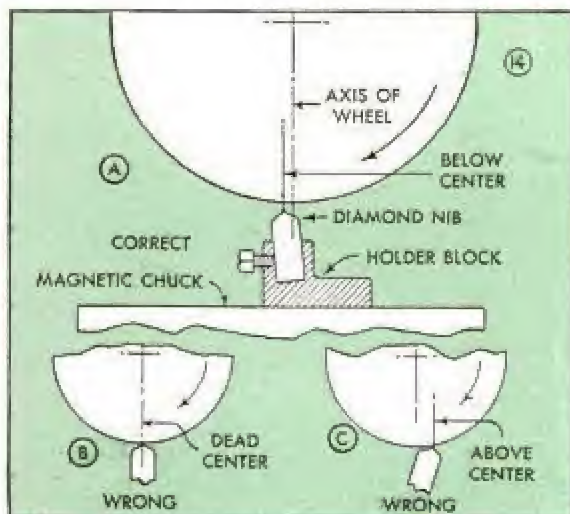
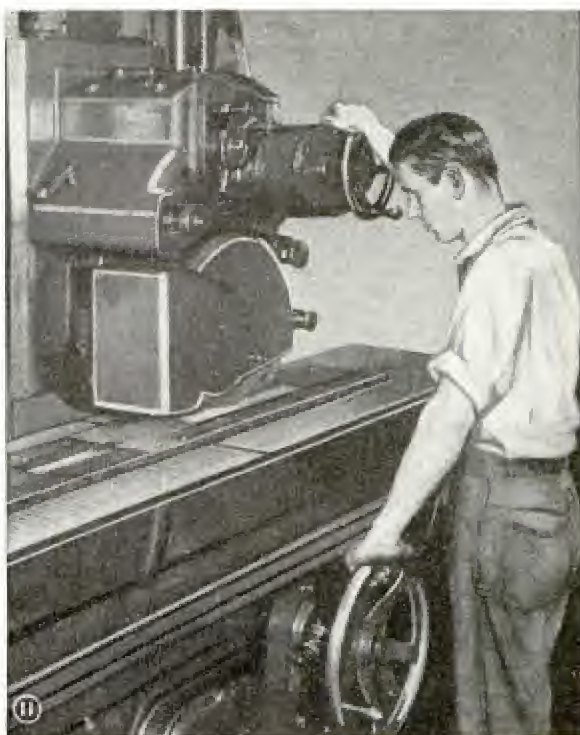


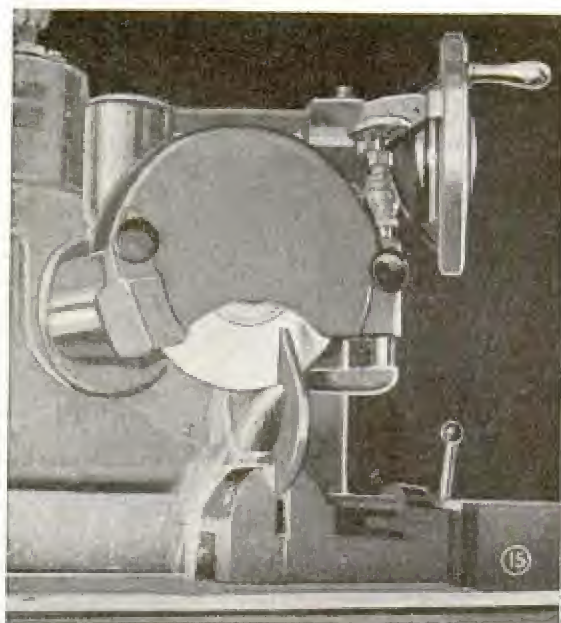
(10) Grinding Wheels to Use for Surface Grinding
(With equipment of the horizontal spindle type)

Material	Wheels
Machinery steel - - -	3836-L-8B
Carbon steel (soft) - - -	3836-K-8B
Carbon steel (hard) - - -	3836-I-10B
High-speed steel (soft) - - -	3846-J-8B
High-speed steel (hard) - - -	3846-H-10B or 3860
Stainless steel - - -	3836-H-8B
Cast iron - - -	3736-J-8T2
Brass - - -	3724-H-8T2
Bronze (soft) - - -	3724-H-8T2
Bronze (hard) - - -	3724-I-8T2
Aluminum - - -	3846-H-8B
Copper - - -	3724-I-7R
Chilled iron - - -	3736-I-8B
Magnetic chucks (important)	3760-H-8L

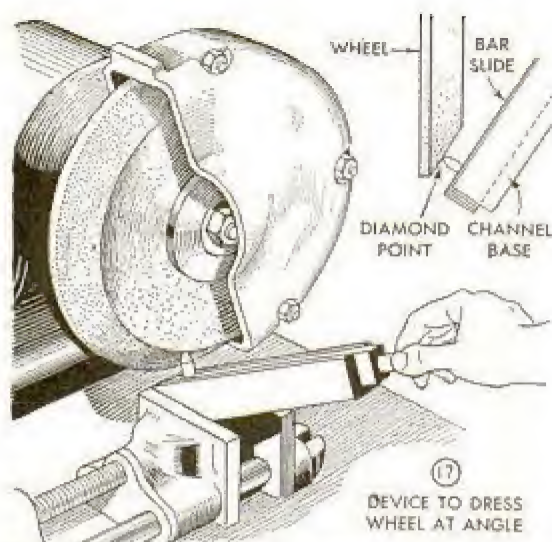
surface grinding depends on the wheel diameter. In all the details of Fig. 8, the sizes of grinding wheels and work as given are based on practical ratios, and in each case the wheel is fed into the work the same distance.

Grinding technique: As modern surface grinders are practically foolproof from the standpoint of functioning accurately, the degree of grinding accuracy is based on the proper selection and use of grinding wheels. The table in Fig. 10 gives general recommendations. Notice that the first two figures are 38 and 37 respectively. Tough materials require wheels of aluminum-carbide grains, expressed by 38, whereas softer materials require silicon-carbide grains, expressed by 37. The harder the material to be ground, the softer the grade of wheel, and vice versa. However, both aluminum-carbide and silicon-carbide wheels have their individual degrees of hardness to fit all metals. The hardness and size of the grains, and their spacing determine the cutting rate and the quality of the finish. For production grinding and some tool work, a coolant is used to speed the job and also improve the finish. On a surface grinder having a large range of movement and equipped with a large magnetic chuck, a considerable number of pieces can be ground in a given time as shown in Fig. 11. Fig. 12 shows how the sides of a part are being accurately squared by using a precision angle plate. In this case the finish had to be extra fine and therefore a 60-grain wheel was selected in preference to a 46-grain wheel. Fig. 13 gives an idea of what may happen when using too hard or too fine a grade of wheel to surface-grind hardened tool steels, although heat treatment may also be the primary cause of the defects. In detail A, a die was hardened incorrectly, which caused internal fractures that are not detected until the grinding stage. If the grinding feed is excessive, and the

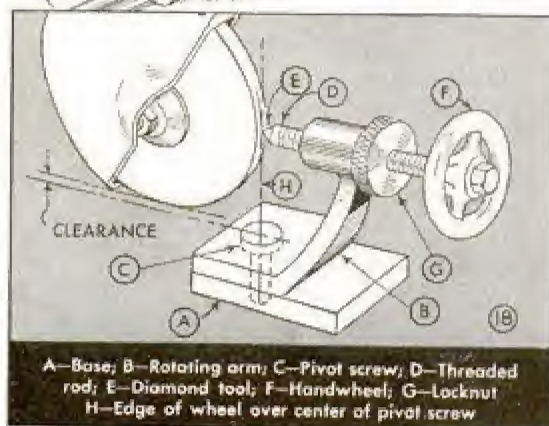




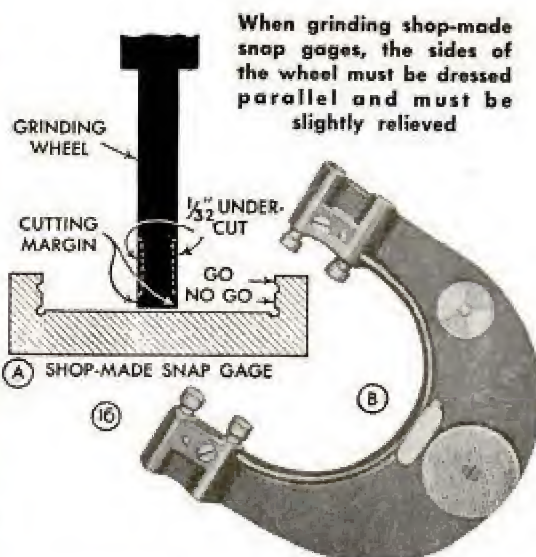
Wheel-dressing fixture in Fig. 17 can be adjusted for straight cuts at various angles. The fixture in Fig. 18 produces a concave or convex face on wheel depending on location of point with relation to pivot



DEVICE TO DRESS WHEEL AT ANGLE



A—Base; B—Rotating arm; C—Pivot screw; D—Threaded rod; E—Diamond tool; F—Handwheel; G—Locknut H—Edge of wheel over center of pivot screw

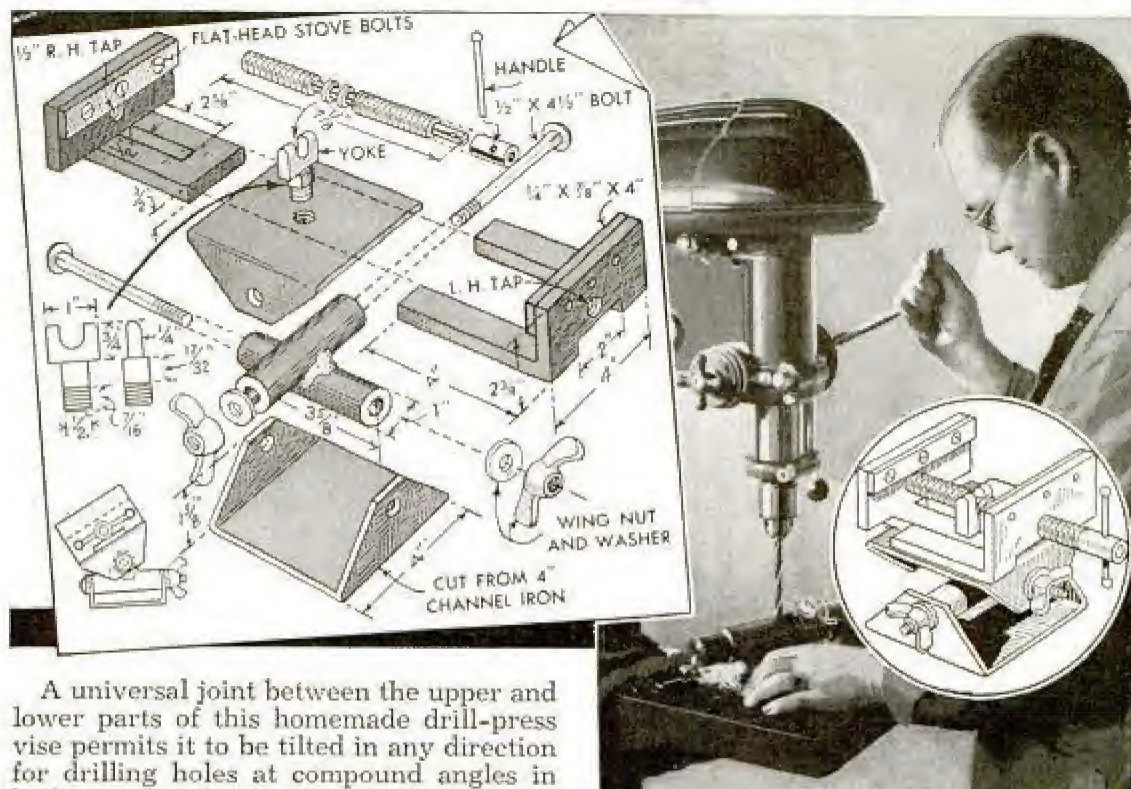


wheel is too hard and not sufficiently open-grained, the internal cracks will gradually work themselves through and become visible. If the heat-treatment is correct, a wrong infeed and a poorly selected wheel will surface-crack the die as shown in detail B of Fig. 13.

Dressing the wheels: When dressing grinding wheels with a diamond nib set into a small steel block, the diamond will stay sharp longer if the holder is set at a slight angle as shown in Fig. 14-A. The diamond is set at the location indicated or below the wheel axis in relation to its direction of rotation which is shown by the curved arrow. The diamond point should not be on dead center as shown in detail B, and results will be disastrous if one attempts a set-up as shown in detail C. For grinding snap gages, Fig. 15, the sides of the wheel should be dressed parallel and should be slightly relieved to produce a cutting margin about $\frac{1}{8}$ in. wide on each side. As shown in Fig. 16-A, the undercut can be as much as $\frac{1}{32}$ in. deep. In this way a minimum of contact area is provided to maintain the maximum of parallelism. Grinding wheels of the H-grade and 80-grain grade will assure four-point accuracy with the grinding of snap gages. Detail B shows a snap gage on which the contacts are adjustable.

Angles can be formed on either or both sides of a wheel with a simple fixture shown in Fig. 17. A device to help in grinding a wheel convex or concave (depending on whether the point is in front or behind pivot), is shown in Fig. 18; a rotating arm is pivoted on the base while a threaded rod holds the diamond tool, the rod being screwed in or out with a handwheel, and locked in any desired position by means of a locknut.

Handy Drill-Press Vise Has Universal Action



A universal joint between the upper and lower parts of this homemade drill-press vise permits it to be tilted in any direction for drilling holes at compound angles in both round and square stock. The jaws of the original were made of angle iron and faced with pieces of old file to provide non-slip surfaces. Before the pieces of file can be drilled for attaching, they will have to be annealed by heating and then quenching quickly in water. The two-part base is of 4-in. channel iron, although it can be formed of flat stock by heating and bending it U-shape. The universal joint consists of two pieces of 1-in. rod which are drilled centrally lengthwise and welded together at right angles as shown. From

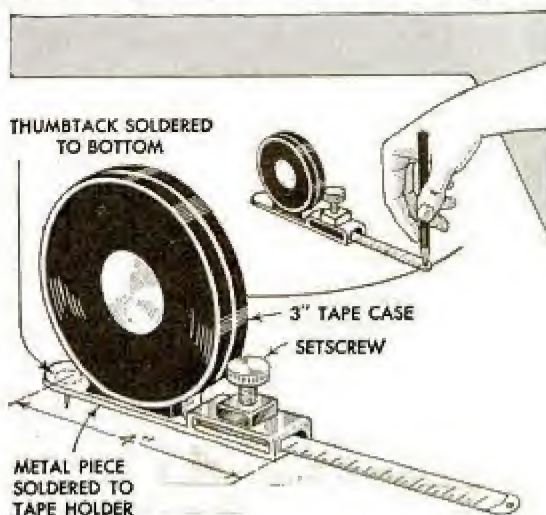
the pull-apart drawing you can see how the various parts go together and the circular detail shows what the assembled vise looks like. Note that the front half of the threaded shaft on which the jaws travel has a left-hand thread, so that the vise will open when the handle is turned counterclockwise. The yoke should fit closely between the shoulders turned in the shaft to avoid any appreciable back lash in closing and opening the jaws.

—Harry F. Steede, Ladysmith, Wis.

Special Base Adapts Steel Tape for Use as Beam Compass

Interfering in no way with its regular use, here's how you can make your steel tape do double duty as a beam compass, the capacity of which is limited only by the length of the tape. From a strip of $\frac{1}{16}$ -in. metal, form a base like the one shown in the drawing and then solder a thumbtack to the underside at one end and a nut for a locking screw at the other. With the clip on the end of the tape flattened, so that it can be slipped under the locking screw, solder the case to the base after first roughening it with a file to assure a good bond. In use, the distance between the thumbtack point and the end of the base is deducted in determining the radius of a circle by the graduations on the tape.

—Opie Read, Jr., Chicago.



Points on Beak of Hand-Truck To Raise Heavy Crates



The difficulty of lifting heavy crates of machinery above the floor for inserting rollers under them led one shop foreman to weld spike points on the beak of a hand-truck. These are forced into the wood of the crate so that the truck may be operated as a lever to lift one end of the crate.

Safe String Cutter on Counter From Window-Shade Bracket

Screwed to a counter or table where packages are wrapped, a window-shade bracket provides a handy cutter for string used in tying the packages. The edges of the slot in the bracket are filed to a knife edge for cutting the string, thus making it almost impossible to injure the fingers accidentally on the sharp edges. You will



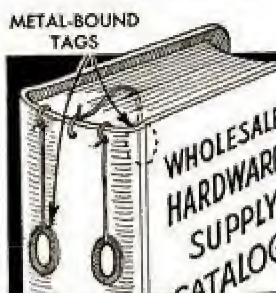
find that the shape of the bracket is such that the string can be looped over it at any point and when given a slight tug will slide into the notch and be severed.

Clamp Holds Loose Paper Sheets Uniformly in Trimmer

When you have a number of loose sheets of paper to cut on a trimming board, they can be prevented from creeping under the trimmer knife by holding them with a paper clamp. This assures that all the sheets will be of a uniform size. In use, just stack the sheets in position for trimming and then slip the clamp over them.



Metal-Bound Tags Mark Pages Of Thick Catalogues



As certain pages in his wholesale supply catalogue were referred to frequently, one owner of a hardware store fitted the catalogue with handy markers improvised from metal-bound tags. These were fas-

tened to the catalogue permanently by attaching them to short strings tied at the top edge of the binding as indicated. In use, the markers are merely dropped between the pages to be located.

Washers Slipped on Bucket Bail Aid in Mixing Poultry Feed

If you have trouble mixing poultry feed accurately when using an ordinary bucket as a measure, loosen one side of the bail and slip several bib-cock washers on it. These can then be used to keep a record of the number of buckets of feed dumped into the mixture



by sliding them all to one side and then shifting one to the opposite side of the bail each time the bucket is emptied.

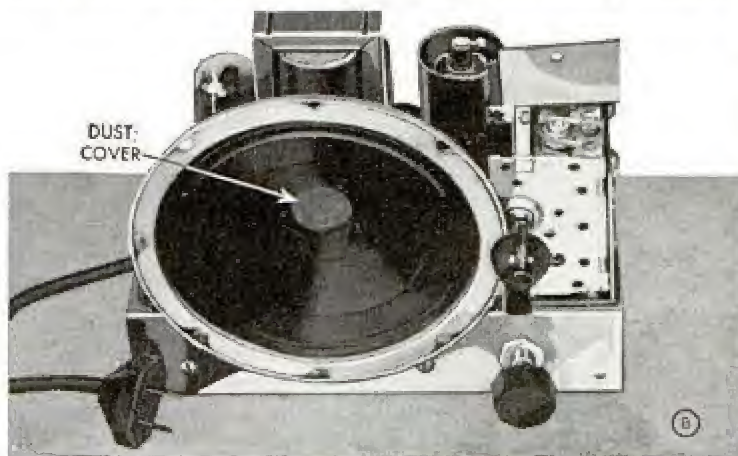
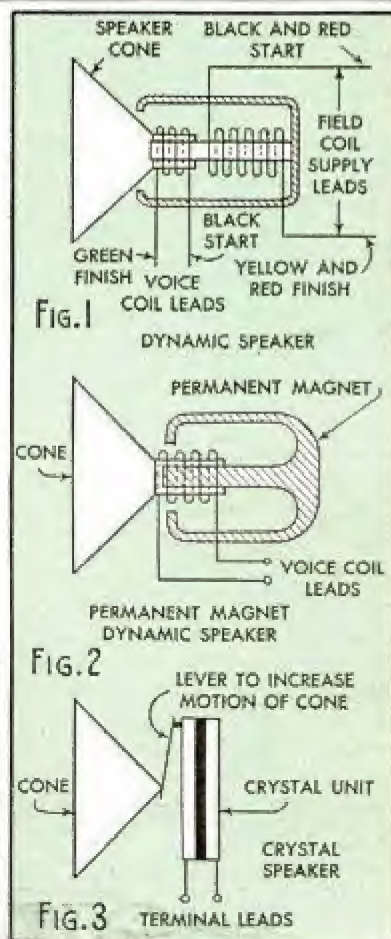
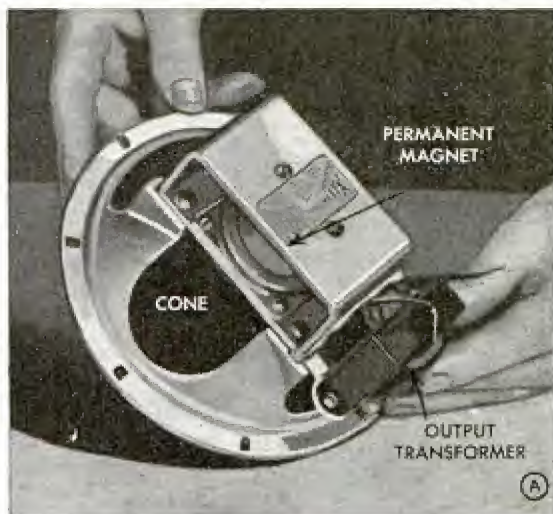
RADIO



LOUD SPEAKERS

CONVERTING the amplified audio frequency currents that issue from the output tubes of your radio receiver into sound waves, the loud speaker is merely a vibrating diaphragm that sets the surrounding air molecules into motion. It operates like the diaphragm in a headphone receiver only on a much larger scale, and the diaphragm is usually shaped like a cone.

The efficiency of any loud speaker is based on the ratio of the usable sound power radiated, to the electrified power supplied to the speaker load. Even the best types now produced are only claimed to be about 35 or 40 percent efficient. However, as the average ear is not critical, this comparatively low quality performance is usually satisfactory. Figs. 1, 2 and 3 show the basic details of three varieties. The dynamic type consists of a large paper diaphragm, to which is secured a very light coil of wire, called a "voice coil." This voice coil is maintained in an intense magnetic field by a coil of wire wound around the pole piece and separately energized. In the type shown in Fig. 2 this field coil and separate power supply are eliminated by the use of a permanent magnet. The crystal type employs the "Piezo-electric" effect of rochelle salt crystals, and no magnet or field supply is required. The adjustment of the voice coil, or other cone-driving device, is critical, and such adjustments should not be attempted by the average set owner, as special tools are required. The permanent-magnet type shown in photos A and B always should be protected by a thin felt dust cover to keep out metallic particles.



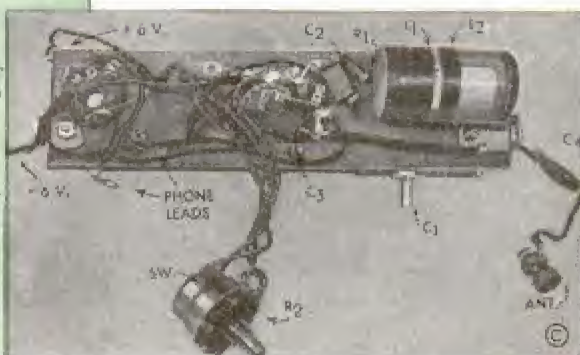
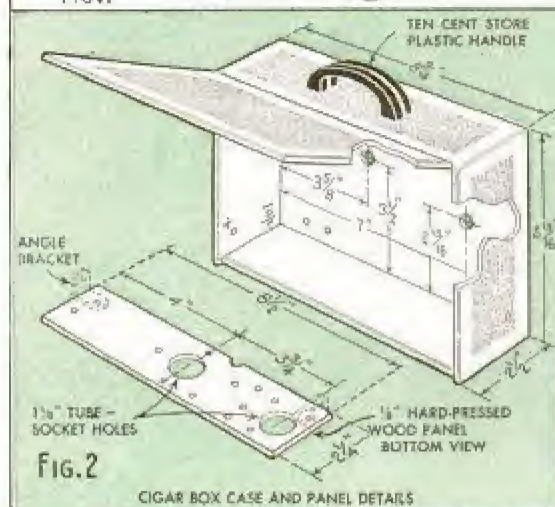
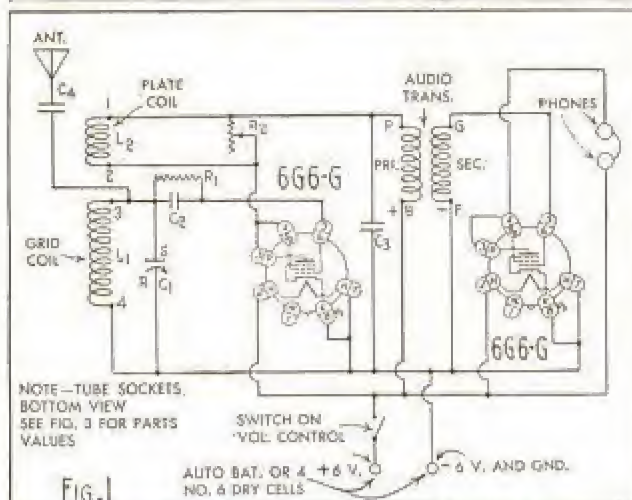
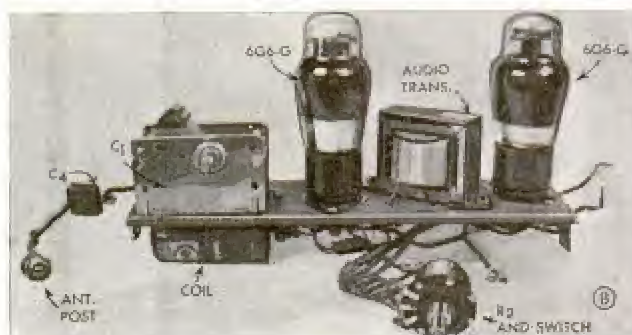
SIX VOLTS WORK THIS

By S. A. Johnson

THIS is an improved wartime version of the 2-tube "Hurricane" emergency receiver originally described in a previous issue of Popular Mechanics Magazine. Like the original model, it requires no B-battery, operating entirely from any 6-volt auto storage battery or four No. 6 dry cells connected in series. Under blackout conditions in localities where a power line supply would not be available for operating standard receivers, and if no dry-cell batteries of any type were obtainable, the nearest automobile would provide a 6-volt storage battery that could be used to listen in on local broadcasting stations for emergency safety and blackout instructions.

Capable of considerably more volume and greater range than the original model, this unit employs two 6G6-G low-drain tubes that require only .15 amp. of heater current, and the B-supply obtained from the same source is so low that it can be disregarded in figuring battery life. These 6-volt tubes are commonly found in the junk boxes of radio students, experimenters, and servicemen.

The schematic circuit diagram is given in Fig. 1, and it will be noted that only a handful of junk-box parts are required. These include an old audio transformer of any type with a 3-1 or higher ratio. These parts are assembled on a small hard pressed wood panel as shown in the simplified wiring diagram Fig. 3 and photos B and C. The assembly is housed in a cigar box and finished off with a ten-cent-store plastic handle, as illus-

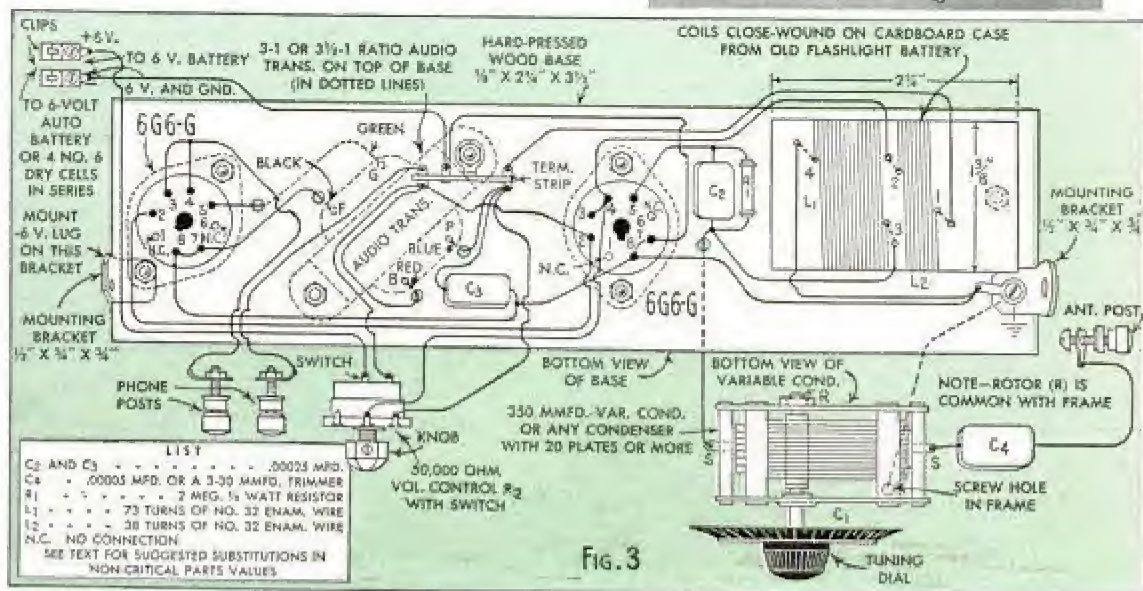
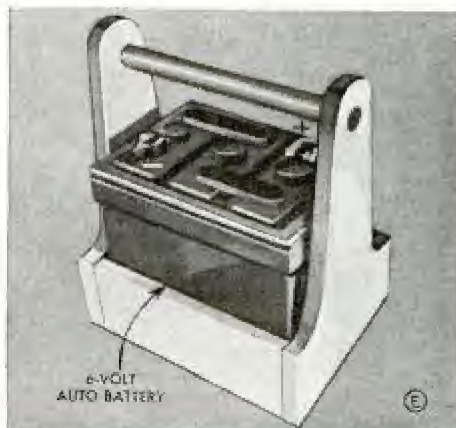


BLACKOUT EMERGENCY SET

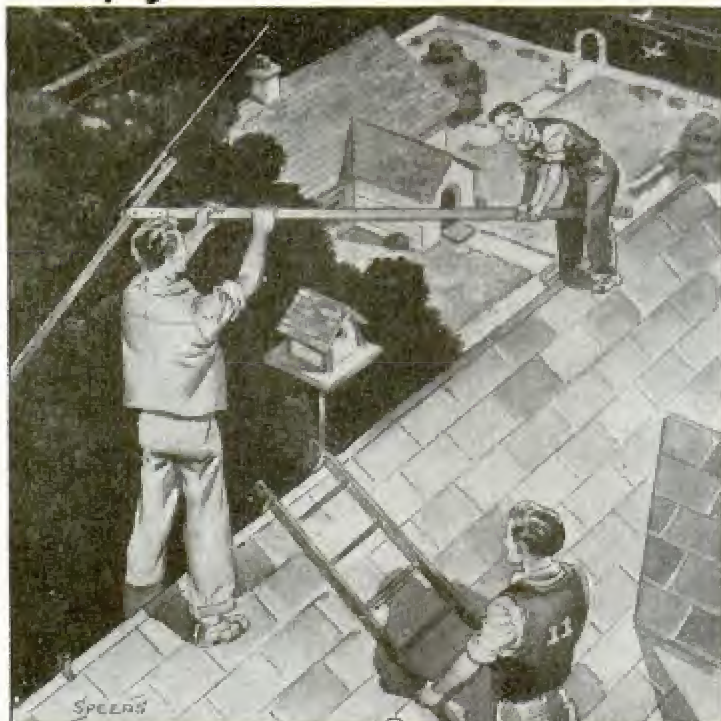
trated in photos A and D. Dimensions and drilling details for this case and panel are given in Fig. 2.

A cardboard tube removed from an old flashlight cell provides the form for winding the coil, the turn data for which is given in diagram Fig. 3. The wire can be salvaged from a burned-out filter choke or an old audio transformer, and can be any size from No. 28 to No. 34, either enameled or cotton covered. Wind coils L_1 and L_2 in the same clockwise direction, space them $\frac{1}{8}$ in. apart and anchor the start and finish ends through small holes punched in the form with a needle. Detailed material list R-319 is available from Popular Mechanics radio department, for student use if desired.

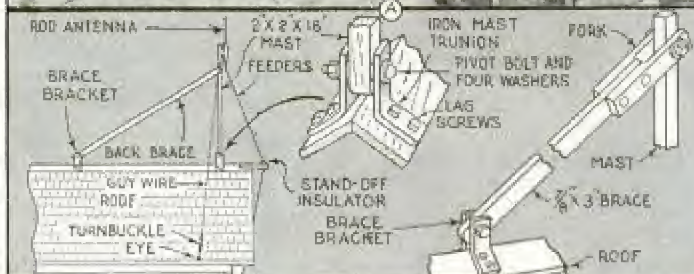
The volume control R_2 is mounted directly on the bottom of the cigar box which becomes the front panel of the set. Two small angle brackets support the base panel, and it will be noted that the mounting screw for one of these brackets is also used to mount the variable condenser C_1 . The antenna binding post is mounted directly on one side of the cigar box; two Fahnestock clips are mounted on the other end of the box for the positive and negative leads from the 6-volt battery. A ground lead should also be connected to the negative 6-volt battery clip. A good ground connection is necessary for maximum results, and a 20-foot indoor antenna is all that is required for local stations. However much stronger signals will be received if a long outdoor antenna is used. For portable use in certain emergency shelter applications, the 6-volt auto battery can be placed in a home-made wood carrying case of simple design as shown in photo E.



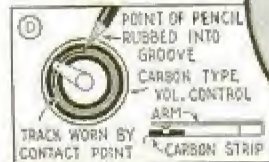
Helpful RADIO SUGGESTIONS



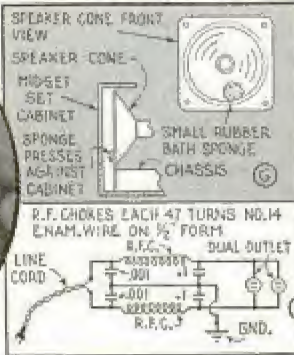
(A) Ridge-pole ultra-high frequency antenna mast for student and WERS applications. Non-critical construction details are given for a mast that is easily raised and lowered to try out various types of rod or di-pole antenna systems. To lower the mast, merely remove the feeders and the brace bolt, and walk back along the ridge with the back brace, as shown in the illustration, until the mast lies flat on the ridge. The guy wires should be located where they will permit raising and lowering of the mast without re-adjustment of tension and prevent side sway during the operation. (B) Insulated screwdriver for radio workers has long plastic handle and is provided with a pocket clip. (C) Extra soldering tip of 1/8-in. copper rod is threaded in a hole drilled and tapped in flat end of regular copper tip for hard-to-reach radio chassis jobs



(D) Temporary repair for carbon volume control in older types of receivers



(E) Handy plastic-handle tool for servicemen combines an aligning tool with a screwdriver. (F) An ordinary paper-type .25 to 2 mfd. 400 volt condenser may be used to determine the presence of voltage in a radio circuit if a voltmeter is not available. Insulate the leads with "spaghetti" tubing, as shown, and place the bared ends across any terminals suspected of voltage. Then remove and bring the leads together; a spark will indicate that voltage was present. (G) Small piece of old rubber sponge stops speaker rattle in midget sets when voice coil is slightly off center. (H) Homemade dual-outlet line filter. Condenser values are not critical, however, these condensers should be tubular paper types rated for either 400 or 600 volts





You may
worry about
feeding
your pets

but you won't worry about your car
with **Marfak Chassis Lubrication**

With Marfak Lubrication you have a sweeter, smoother-running car. For Marfak, you see, is one of the finest, most thorough and efficient chassis lubrication services ever devised.

Your dealer works with a scientific Marfak chart. He checks every vital point on your car, from battery and tires to differential and rear-end gears. No guess-work here—the job is *accurate*, to protect irreplaceable engine and chassis parts.

Insist on genuine Marfak Lubrication today—to keep your car in “top” condition. At Texaco and other good dealers everywhere.

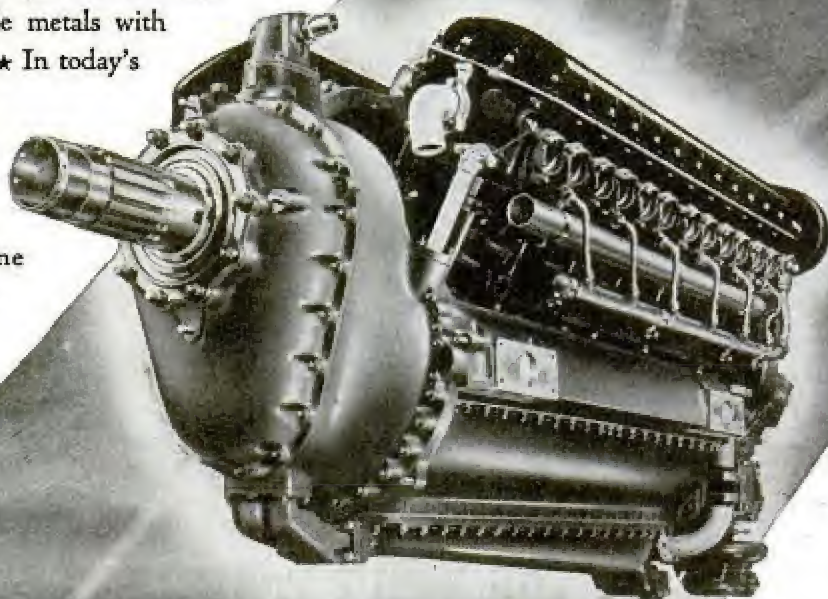


Tune in the TEXACO STAR THEATRE every Sunday night. See your local newspaper for time and station.

You're Welcome at **TEXACO DEALERS**

BRILLIANCE WITH A PURPOSE

Like mirrors and jewels is the sparkle of polished metal parts in an Allison—but the eye cannot begin to see the perfection this brilliance reflects. ★ For one of the challenges in making aircraft engines is this . . . ★ To preserve — by exquisite accuracy of manufacture and finish—all of the inherent strength and endurance in every ounce of material used. ★ This need for perfection is nothing new to Allison. For years it has been our special province to handle metals with precision and lapidarian skill. ★ In today's tasks we are advantaged by all that General Motors has to offer in production techniques. ★ The result is a liquid-cooled aircraft engine which in performance can speak for itself—and an engine which we are resolved to make the finest in the world.



KEEP AMERICA STRONG
BUY MORE BONDS

**POWERED BY
ALLISON**

P-38—Lightning
P-39—Airacobra
P-40—Warhawk
P-51—Mustang

LIQUID-COOLED AIRCRAFT ENGINES

Allison

DIVISION OF



*"Good Pictures"
bring you
together*



Send your soldier "Good Pictures"... of the old familiar scenes... the home place, the best girl, the old fishin' hole, sister Mary's new baby, the puppy now a dog, the cabin up the river... all the happy scenes of home sweet home. That's what counts a thousand miles from nowhere.

Make the most of your present camera! Take good care of it, and conserve vital film by making each picture a good picture. After Victory Argus will make new cameras... employing the new techniques and extensive experience acquired in War Production.



AWARDED TO PLANT 2
OPTICAL DIVISION

"Good Pictures"

Make the best use of your present equipment—learn more about lenses—films, filters and composition. Send 25c today for this 56-page booklet.

FINE AMERICAN CAMERAS
•
PRECISION OPTICAL INSTRUMENTS
•
AVIATION RADIO EQUIPMENT
•
BUY WAR BONDS

argus

INTERNATIONAL INDUSTRIES, INC.



ANN ARBOR

MICHIGAN



"Maybe next year, Queenie!"

"Mallards! Gosh, don't they remind me of some swell times!"

"Gets you kind of excited too, Queenie, doesn't it? I understand. My dog was a lot like you, and I know how he loved hunting."

"There'd be cold, gray autumn mornings when the wind almost blew our ears off. I'd paddle out to our favorite hunting place. Pretty soon our decoys would be bobbin' away. Some mallards would start down to get chummy—then—whammo!"

"No matter how far away the ducks dropped, that dog of mine used to retrieve 'em every time. I'll bet you did too. And boy, what wouldn't we both give to do some duck hunting this season!"

"But there's a war on now, Queenie. We're in the Coast Guard, and we've got a job to do. Maybe next year..."

Remington's job right now is to supply a lot of military arms and ammunition fast—to help speed, among other things, the return of hunters and hunting dogs to their favorite marshes. Here is what we are doing...

1. *Every working day, Remington produces thirty million rounds of military small arms ammunition.*
2. *And, every working day, Remington produces more than enough military rifles to equip an entire infantry regiment at full fighting strength.*

After the war is won, we will again be serving our sportsmen friends with Remington shotguns and rifles, Nitro Express shells, Kleanbore Hi-Speed .22's, and Core-Lokt big game bullets. *Remington Arms Company, Inc., Bridgeport, Conn.*

"Nitro Express," "Kleanbore," and "Hi-Speed" are Reg. U. S. Pat. Off.
"Core-Lokt" is a trade mark of Remington Arms Co., Inc.

**HELP YOURSELF LATER BY HELPING YOUR
COUNTRY NOW, BUY WAR BONDS!**

Remington



White Magic

(Continued from page 75)

emits a golden light twice as powerful in lumens per watt as the incandescent lamp. Preservation of food in brine may help solve today's canning problems; at North Carolina State College, experimenters have successfully salted down lima beans in brine. Salt is now being employed in the subsurface of paved roads, acting as a stabilizer and antifreeze.

It's an old Russian custom for the newly-weds to fling grains of salt into the corners of their first home to assure happiness and health. That's one of many salty superstitions, among them our own notion of luring luck by tossing a pinch of salt over the left shoulder. The Morton Salt Company suggests a few more productive uses for "white magic" around the house:

Salt is an excellent gargle, dentifrice and cleaner for open wounds. A salt water bath is good for aching feet, a mild solution is a natural eye bath, and it has even been recommended as a hair tonic. Iodized salt is a goiter preventive.

A little salt sprinkled in the pan before the fat will prevent splashing when frying meat. Parsley sprinkled with salt chops easier and finer. When a boiling egg cracks, a pinch of NaCl helps to keep the egg from boiling out. A pinch of salt keeps milk fresh longer, and you can keep butter hard without ice by setting the dish in cold salt water. Soak nuts overnight in salt water and the meats will come out whole. Hot brine poured down the drain once a week helps clean out the grease. A salt-and-turpentine bath will restore whiteness to yellowed enamel bathtubs. You can concoct a good dry cleaner by mixing equal parts of salt and cornmeal, moistened well with turpentine. Ants will retreat if salt is sprinkled where they gather. On the other hand, the goldfish will thrive on a teaspoonful of salt every week. To get rid of egg stains on silver, rub with salt and then wash in warm water and soap.

Or try this. Place a few irregular lumps of coal in a shallow dish and pour in two inches of salt brine containing an excess of salt. Gradually the snowwhite crystals will creep over the entire surface of the coal in a cauliflower-like growth, which can be colored with red ink or watercolors. The salt garden is not utilitarian, but it's amusing.

No wonder the Indians called it White Magic.

¶To learn where to buy commercial products described in these pages, see the index.

RADIONICS*

**“the impossible we do immediately
the miraculous takes a little longer”**

ARMY SERVICE FORCES —

The Army is . . . men . . . trained men . . . equipped and maintained. On the home front . . . in factories and on farms . . . civilians produce the armament and food and supplies. The bridge between civilians who furnish and soldiers who use . . . is . . . the Army Service Forces. Wherever the soldier is . . . whatever he does . . . the Army Service Forces are charged with seeing that he lacks no essential thing. To fulfill the task outlined in the twenty-one words above . . . literally . . . the “impossible” and the “miraculous” become daily routine with the Army Service Forces.



“AYE, AYE, SIR”

In old English, “Aye” meant “yes.”

It means far more in the Navy.

“Aye, Aye, Sir,” means that the order is understood and will be obeyed.

The Navy has given Zenith many “orders” since this war began.

Our prompt “Aye, Aye, Sir,” has, we believe, been justified by the “intelligence and initiative” (as the Navy says) with which these orders have been executed.

—in days of civilian radio, Zenith was proud of its long series of “firsts”—improvements which made radio history and established leadership in the industry.

—today our viewpoint has changed—materially.

—engaged exclusively in war production, the things we have been called upon to do—the tasks we have succeeded in accomplishing, make past improvements in civilian radio literally look like “child’s play.”

—the work of our engineers in radionics has made the “impossible” possible and accomplished the “miraculous.”

*—mark that word “RADIONICS” (with its subdivisions of Electronics, Radio, etc.)—it has brought into reality and being, devices which only a year or so ago came in the “impossible” and “miraculous” categories.

—today Zenith works in the science of radionics for our armed forces alone.

—in that bright “tomorrow” when peace returns—

—we can only say—the post-war radios that Zenith will produce will contain many interesting new developments.

—that statement is based upon experience which we can not now reveal—but you may take our word that it is a fact.

ZENITH RADIO CORPORATION, CHICAGO

BETTER THAN CASH

U. S. War Savings Stamps
and Bonds

ZENITH
•LONG DISTANCE•
RADIO
RADIONIC PRODUCTS, EXCLUSIVELY—
WORLD'S LEADING MANUFACTURER

Avoid those "Icicle evenings"



PROTECT HOME COMFORT WITH BALSAM-WOOL ATTIC INSULATION



Tooth-chattering "evenings at home" aren't fun! But there's no need to endure chilly, uncomfortable rooms. At low cost, you can make your home far more comfortable—and save up to 20% in fuel at the same time—by applying Balsam-Wool Insulation in your attic.

Applying Balsam-Wool is as easy as laying a carpet! That's because Balsam-Wool is a finished insulation—tailored for quick application. Wind-proof, moisture-proofed and fire-resistant, it is scientifically designed for lasting efficiency—and sold under a money-back guarantee of satisfaction.

● Make this lasting investment in comfort and fuel saving. See your lumber dealer about applying Balsam-Wool in your attic—or mail the coupon for full information.

Balsam-Wool

SEALED INSULATION

WOOD CONVERSION COMPANY
Dept. 210-11, First National Bank Bldg.
St. Paul, Minnesota

Gentlemen: I want to know more about Balsam-Wool Double Value Attic Insulation.

To assist us in giving you special information, please check: I am a home owner ☐, renter ☐, architect ☐, student ☐, contractor ☐.

Name.....

Address.....

City..... State.....



141 W. Jackson Blvd.
Chicago, Ill.

Industry's Dr. Jekyll and Mr. Hyde

(Continued from page 45)

Dicalcium phosphate and tricalcium phosphate are among the finest polishing agents for tooth pastes. The former, as made by Victor Chemical Works, is milled to a powder so fine that the largest particle is less than 1/1,200 of an inch in diameter. The tricalcium phosphate, Victor experts point out, is not only used in dentifrices but also as a base for face and beauty creams, for mineral fortification of foods, and as a container to prevent salt, soda and sugar from caking.

Monsanto Chemical Co. also points out that derivatives of phosphorus are used in oil well drilling muds, in sugar clarification processes, and in rustproofing metals.

In the past few years, according to Henry W. Easterwood of the Victor Chemical Works, hundreds of patents have been taken out for uses of organic phosphorus compounds, among the uses being: Preventing fatty oils from becoming rancid; improving hair dressings; flameproofing cellulose acetate, rendering wood termite-proof, and mothproofing wool.

Phosphorated oils are finding uses as plasticizers and softening agents in some types of resin products. Other compounds of phosphorus are used in flotation agents for ore separation, as sprays for plant pests, as stock foods, to acidulate soft drinks, and to make biscuits one-third lighter than Mother—even Grandmother—could make.

Thus, firebrand or friend, in war and for long after the war ends, phosphorus will continue its anonymous job of affecting everyone's daily lives. When you brush your teeth tonight, consider that the same "Dr. Jekyll" that's keeping your molars white might, as Mr. Hyde, be burning down your house.

Engineering for War and Peace

(Continued from page 37)

rushed by taxicabs from another plant. Designers, engineers and workmen stuck to the job all night and by dawn the first bomb adapters were trucked to an airport, taken by a waiting transport plane and reached the bomb crews several thousand miles away 90 hours later.

Another tough one was to design an airport ground light that would withstand the load of a heavy bomber rolling over it. The engineers built a new runway marker lamp using the principle of bridge design, capable of enduring a 100,000-pound load. While they were doing it they designed a

(Continued to page 152)



Millions of "Small Arms" Essential to Victory

The sporting arms industry of America ... long skilled in the ways of gun-making ... undertook a tremendous task in production of arms for our Government and its Allies.

The record of its achievement, in quality and stupendous quantity, is a vital factor in America's guarantee of victory.

"Savage" with its thousands of workers is proud to be a part of this industry's important war effort. Reports from all parts of the globe record the effective performance of the Browning Aircraft Machine Guns, and other guns and military rifles produced in our plants.

Savage Arms Corporation, Utica, N. Y.

Buy Wisely — Buy War Bonds

SAVAGE



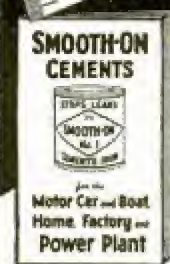
Since award to Savage of the Army-Navy "E," new and higher production schedules have been exceeded.



SAVAGE AUTOMATIC SHOTGUNS will resume their steady rise in popularity which, before the war, culminated in the introduction of the lightweight model for upland hunting.

A PROTRACTOR-RULE

and a REPAIR HANDBOOK



both sent
FREE

if you mail the coupon

Here are TWO handy helps every householder and handy man should have, and which are available without charge to the readers of this magazine.

1—A durable metal protractor, with black letters on a white background for greatest legibility, with angles reading in both directions, and with an inch scale on the straight side.

2—The 40-page Smooth-On Handbook, with simple instructions for time-saving, labor-saving and money-saving repairs to household and auto equipment, etc. Illustrated by 170 diagrams.

The instructions in this handbook are based on the experience of thousands of mechanics and repair men, and include much information not to be found in any other publication. Some of the subjects covered:

How to seal cracks in boilers, stoves, water heaters, radiators, pipes, auto engine water jackets, gear cases, etc.

How to stop leaks at seams, bolts, rivets, threaded or flanged joints, etc.

How to tighten loose parts of furniture, apparatus, fixtures, utensils, tools, etc.

How to waterproof concrete, brick or stone floors, walls, cisterns, pools, etc.

Get Smooth-On No. 1 in 1 $\frac{3}{4}$ -oz., 7-oz., 1-lb. or 5-lb. container from your dealer, or if necessary from us. For your protection, insist on SMOOTH-ON, used by mechanics and repairmen since 1895.

Send the coupon TODAY to be sure to receive the free protractor and repair handbook before the supply is exhausted.

SMOOTH-ON MFG. CO., Dept. 37
574 Communipaw Ave., Jersey City 4, N. J.
Please send the Protractor and the Smooth-On Repair Book.

Name
Address
11-43



Do it with **SMOOTH-ON**

simpler lens with eight percent higher lighting efficiency.

The searchlight on a submarine called for stamina, too, so they built one that can take the blow of heavy waves, the shock of gunfire a few feet away, with a stainless steel reflector impervious to salt water corrosion and a 1,000-watt filament lamp in heat-resistant glass unaffected by dousing in an arctic sea a minute after it has been burning.

Supercharging engines and planes for flight seven miles high posed plenty of problems. Now the engineers are perfecting an ingenious automatic control for the supercharger drive. Since the supercharger must run faster as the altitude increases, they contrived a way to use the density of the air as an automatic control. In rarer air the fan tends to run faster and the amount of current needed to operate it decreases. The new control interprets this current drop as a demand for faster motor speed and steps up the voltage of the supply generator proportionally. Thus cabin interiors will automatically be kept at a safe pressure. Another item on the high-altitude flight program is an adaptation of the common photoelectric cell; a tiny light is passed through the lobe of the pilot's ear to a photocell from which an instrument reading is taken indicating the oxygen content of the pilot's blood.

Your sealed-beam automobile headlight is the landing light of Yankee bombing planes. Your air-conditioning outfit is giving a hot and cold shock treatment that kills moths in army uniforms.

Peacetime engineering has given us wartime production supremacy. The secrets that are being unwrapped in wartime engineering laboratories will come home to you in the next peace. There is an average lapse of seven years from an invention to its practical commercial application. But it is likely the momentum gained under wartime conditions will enable American industry to rebuild your world quickly when the gunning ceases.

Cheating Death at Sea

(Continued from page 25)

ing but a sheet of rubber between them and water miles deep. The epics of shipwrecked wanderers have made the rafts a familiar and dramatic feature of the war. Collapsible boats now come with paddles, a sail, and a covering which serves as an awning, screening off wind, sun and rain. No longer need the larger types of rubber craft drift aimlessly, since they can be

(Continued to page 154)



*There's been
a
big change*


● Sentiment about the old things is an admirable American trait. But even the most sentimental of us must admit that change frequently is for the best.

An outstanding example of progressive, beneficial change is that which Tyson has made in tapered roller bearings. Tyson improved the old-time conventional bearing by adding an average of

30% more load-carrying rollers. Result: Tyson users enjoy greatly increased load capacity—almost doubled bearing life!

* * *

These users often tell us that the Tyson "All-Rolls" Bearing is the greatest improvement in tapered roller bearings in forty years. *The big name in bearings today is—TYSON!*

 TYSON BEARING CORPORATION, MASSILLON, OHIO

COUNT THE ROLLS • THE ROLLS COUNT

Tyson
TODAY'S HEAVY-DUTY BEARING



★ BACK THE ATTACK — WITH WAR BONDS ★



Dear Jim:

You ought to see

the interest in motorcycles around here. When our outfit comes in from maneuvers the fellows all crowd around asking questions and begging rides. Believe me, our Club is going to have plenty of new riders after the war.

These military Indians are honeys! They take punishment like regular champs -- and they're easy to handle and safe, just as Indians have always been. Wish I could tell you about the new Indian improvements, but military secrecy won't let me. Regards to all the Club members.

INDIAN MOTORCYCLE COMPANY, SPRINGFIELD, MASS.



BUY WAR BONDS NOW

★ ★ TO BUY AN INDIAN LATER ★ ★

navigated just like a lifeboat of wood or steel. The fabric package which protects them until inflated can be converted into a steady sea anchor.

Literally hundreds of other devices have been developed to save lives at sea. More efficient breeches buoys transfer men from ship to ship and some serve as life preservers in case of a slip up. Metal baskets with complicated rigging lessen the chance of additional injury to wounded men as they are transferred from one vessel to another. Rubber flotation bags either keep land-type planes afloat for hours, or long enough to give the crews time to escape. Waterproof signal lights have been perfected, some of them equipped with keys so that Morse code messages may be tapped out. Watertight containers have been made for flashlights, medical kits and for provisions.

While it can't be said that a man shipwrecked during this war has all of the comforts of home, it is true that this nation is supplying its seafarers with every practical device Yankee ingenuity can think up.

Wild Horses of the Sky

(Continued from page 65)

whole—a tribute to his flying ability as well as to the sturdiness of the craft.

The Mustang was first used by the British Army Cooperation Command. It has a wide track for its front wheels for stability on the newly-prepared airfields on which an advancing army might have to rely. But until needed for actual invasion support—as camera planes, strafers, spotters, and air arms of the ground troops—the Mustangs were sent on frequent independent missions over the continent.

In that capacity they made ferocious raids on German-held railways, canal and sea transport, troop concentrations, gun emplacements, powerhouses, hangars, radio stations and the like. Though its armament officially is restricted, it has been credited with carrying eight machine guns—four .50 caliber and four .30 caliber—besides a high-speed automatic camera.

Making its bow with the United States Army Air Force, the Mustang, or P-51, has also acquired a new designation, the "A-36." Under that name it is converted into a dive bomber.

British correspondents have tended to rave over this knife-prowed fighter with the name romantically suggestive of the wild and woolly days of the American southwest. They have credited it with a speed of "well over 400 miles an hour." More than one officer has flatly called it the

(Continued to page 156)



Little BUT Mighty

IN WAR AS IN PEACE

A piston ring looks insignificant alongside a mighty gun. Yet both are necessary—to winning the war.

Consider that the simple, inexpensive installation of a set of piston rings can be counted on to restore performance and economy in a worn motor—for many more thousands of miles.

Consider that neglecting to repair an oil-pumping motor may result in a breakdown that will leave you without a car—indefinitely.

Obviously, the sensible thing to do is see your motor service man *before* trouble begins.

Should he find the installation of new piston rings advisable—and recommends Hastings Steel-Vents—you will know he does so out of experience.

HASTINGS MANUFACTURING COMPANY, HASTINGS, MICHIGAN
Hastings Mfg. of Canada, Ltd., Toronto

It's a privilege to buy War Bonds

➡ **HASTINGS** ➡

STEEL-VENT PISTON RINGS

*Tough on Oil-Pumping
Gentle on Cylinder walls*



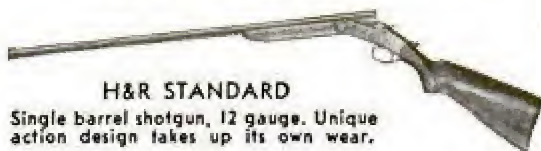
H&R WARTIME LINE

Available Now for Essential Use



**THE H&R REISING
SEMI-AUTOMATIC RIFLE**

Caliber .45; bottom-fed from 12 or 20 cartridge clip; fires as fast as trigger is pulled; effective range 400 yards; weight with magazine 7 lbs. Excellent weapon for police, guard or military use.



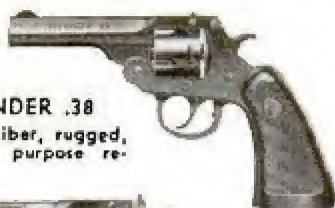
H&R STANDARD

Single barrel shotgun, 12 gauge. Unique action design takes up its own wear.



**H&R FLARE PISTOLS
MARK IV; MARK VI**

For ball or parachute flares; 37 mm. and 1" bores.



H&R DEFENDER .38

Five shot, .38 caliber, rugged, precise, general purpose revolver.



H&R SPORTSMAN

Nine shot, .22 caliber. World-famous for crisp action and balance.

WRITE for your free copy of the Manual of the H&R Reising Sub-machine Gun. Also now in preparation—a more detailed catalog of the H&R wartime line covered briefly here; we'll reserve a copy for you at your request—will mail it as soon as it's off the press. Harrington & Richardson Arms Company, Worcester 2, Mass., U.S.A.



H&R

FINE FIREARMS

For Sportsmen, Police, and the Military

fastest reconnaissance craft in the world. A correspondent wasn't censored when he said observers estimated the speed of a Mustang in level flight barely above the tips of the trees, at 425 miles an hour.

The plane's range, too, is astonishing. Mustangs were the first single-engined fighters in the history of British aviation to make raids into Germany from bases in England. On their first such flight, in October, 1942, they flew 250 miles east, attacking objectives on the Dortmund-Ems canal, a round trip of well over 500 miles.

In one month Mustang squadrons rang up more than 100,000 flying miles, destroying, incidentally, 42 railway engines.

Any collapse of Hitler's continental supply lines can be credited in great part to the Mustangs, which have long carried on a personal grudge fight against German trains. Hedge-hopping across the tracks, pilots blow up the locomotive boilers.

In one raid, a pilot destroyed a freight engine and 30 cars. In one week, Mustang pilots knocked over 19 locomotives, seven tugs, and numerous barges and trucks. Within two minutes one Mustang pilot shot down an Me. 109 and a Junkers-52 troop carrier, then set fire to two ships. A Mustang-flying wing commander in 25 minutes damaged or set afire two armed launches, a tug, a steamer, and a locomotive.

Sensation of watching the Mustang in flight is its amazingly fast and silent approach. It bounds in just above trees and buildings, hugging the earth so enemy gunners cannot get a long-range shot.

There is no distant engine drone, growing louder as the plane approaches, but a sudden screaming roar overhead, and the wild horse is upon you.

"Tough, maneuverable, no vices," is the laconic verdict of one British pilot.

"A good plane to have on our side."

Airline to Anywhere

(Continued from page 11)

five months before the last of the marooned crew was taken off, and through those five winter months Capt. Kenneth H. Turner and his crew kept ferrying supplies to them.

"With the days only a little over two hours long part of the time," General George relates, "through the worst kind of winter weather, Turner and his men kept them alive. They carried arctic clothing to them, sleeping bags, stoves, walkie-talkie radios, medical supplies and instructions, and food of course. Mainly they dropped army rations, but they also managed some delicacies like canned chicken, even some

(Continued to page 158)



HOW TO WHITTLE DOWN A WOLF PACK

FIRST STEP in sinking a sub is to *see* her. And if you don't see her *soon* enough, it may be the last sub you'll *ever* see.

First to last, sub hunting from the heaving deck of a freighter calls for precision teamwork by the gun crew, and for precision instruments. Particularly, precision *optical* instruments to help you see and sight your target.

Such instruments are required in unprecedented numbers for every operation in this war. To help meet this need, Universal is making them for the Army, Navy, Marines and the United Nations, in *quantity production* hitherto

thought impossible where nothing but the finest will do.

Today, thanks largely to Universal engineering research, outstanding accuracy in lens-making is achieved more economically than ever before, *anywhere in the world*.

Result: a new impetus in the development of photographic and optical instruments . . . promise of finer-than-ever cameras available to everyone.

Straight lines through optical flat indicate perfect flatness.



PRECISION IN THE MAKING

Measured in fractions of lightwaves

One half wavelength of light is the tolerance allowed for prism flatness in Universal Binoculars. Variations of more than 1/100,000 of an inch—show up as curved lines instead of straight ones when the prism is inspected through the optically perfect master.



There's only one flag we're prouder of!

UNIVERSAL CAMERA CORPORATION

NEW YORK • CHICAGO • HOLLYWOOD

Makers of Precision Photographic and Optical Instruments • Peacetime Manufacturers of Cinémaster, Mercury, Corsair Cameras

"Off we go, into the wild blue yonder..."*

Valiant, indeed, are those who have made this song their battle hymn. Who of us can honestly say that he would not turn back time, given the chance, to be able to join their select company—to consort with avenging eagles?

Let's not forget that we can and do go with them directly in proportion to the War Bonds we buy. Then, too, many like us, producing equipment for their use, have a hand in their welfare—the ability and determination to build something better so that they will be better equipped to triumphantly fulfill their missions.

Champion Spark Plugs are but one small, vital piece of equipment produced for the air forces. But vital they are, and so into them we pour all the skill of our thirty odd years in the spark plug business exclusively, plus that extra zeal for Victory which motivates all of us.



*By special permission of Carl Fischer, Inc., copyright owner of "The Army Air Corps," Robert Crawford, Author and Composer.

CHAMPION SPARK PLUGS



BACK THE ATTACK—WITH WAR BONDS

Say you saw it in Popular Mechanics!


butter and candy bars. They dropped some mail to them; that helped a lot."

The winds were too violent to parachute supplies, so the crew flew over the wrecked plane at 50 feet and "bombed" the men with packages. When the rescue was finally made, Turner and his crew flew on to England and delivered their Fortress.

Pilots of the Air Transport Command range from 21 to 46 years old, many of them commercial air line pilots now under army orders, and more and more of them women. The girls are being recruited as Air Transport pilots at a rate of 75 every six weeks, and, General George reports, "I can tell you they're good, too. They fly everything the men fly except the four-motored bombers, and I wouldn't be surprised if they delivered some of them one of these days, too. We anticipate that eventually 40 percent of the transport flying in the United States will be done by women."

The ATC flies a variety of cargo planes, some of them two-story freighters with an elevator to load through the upper door and another loading door in the belly. There is the Douglas DC-3, the conventional "workhorse of the air lines," and its conversion models, the Army C-47 "Skytrain," and the C-53 "Skytrooper," with wood floor, benches for troops, and a tow cleat on its tail for towing gliders. There are the Boeing and Martin and Vought-Sikorsky flying boats, the Boeing Stratoliner and Lockheed Lodestar, Consolidated's famed "Catalina" flying boat, the big Douglas DC-4 "Skymaster," and the new Lockheed "Constellation," that flies faster than a Jap Zero and is easily recognized by its sharklike fuselage and triple tail assembly. The Curtiss "Commando" was added since the war began. And one of the busiest of the ATC fleet is the Liberator bomber, translated into a troop carrier or into the C-87 cargo plane. Yet none of these aircraft was primarily designed to

(Continued to page 160)



Model Builders Attention!

	V	V-2	V-3
Hex	1/2"	3/4"	5/16"
Thread	3/4"-24	1/4"-32	1/4"-32
Thread Length	7/32	7/32	5/32
Weight, Grams	8	3 1/2	2 1/2

Actual Size V-Plug

Champion spark plugs for model gas engines give the same dependable performance as regular Champions. Sillment sealed. Sillimanite insulator. Alloy needlepoint electrodes for easy starting. One piece construction.

CHAMPION

SPARK PLUG COMPANY • TOLEDO, OHIO

POPULAR MECHANICS



Here's how the Navy is using your
GENERAL ELECTRIC auto dome light

Equipped with special new shock-resistant filaments, this old friend is withstanding the pounding waves and the vibration of powerful motors on harbor patrol boats. And remember mother's sewing machine light? It's been adapted for Navy signal devices and instrument illumination. All in all the Navy is using 102 different G-E lamps.



Here's how you can make your present General
Electric Lamps **"STAY BRIGHTER LONGER"**

Take the G-E sealed beam headlamp on your car, for example. Traffic dust, dirt and grease on the lens may cut your light as much as 50%. By keeping your car headlights clean and adjusted, you may help save a war worker's life, not to mention your own. Don't waste light at home either. Keep your lamps and fixtures clean and turn off lamps that are not needed.



Here's how you can be sure of getting
the benefits of General Electric lighting research
when **"THE LIGHTS COME ON AGAIN"**

Will lighting—everywhere—take on new dimensions after the war? Will homes really enjoy sunlight? Will we enjoy the wonders of fluorescent lighting in our homes? Will we kill germs with light? The answer to these questions about the lighting of tomorrow are being explored in General Electric laboratories. But of this you may be sure: The G-E monogram on a lamp bulb will continue to be your assurance of lighting progress, through research.

Hear the General Electric radio programs: "The Hour of Charm", Sunday 10 p.m. EWT, NBC; "The World Today" news every weekday 6:45 p.m. EWT, CBS.

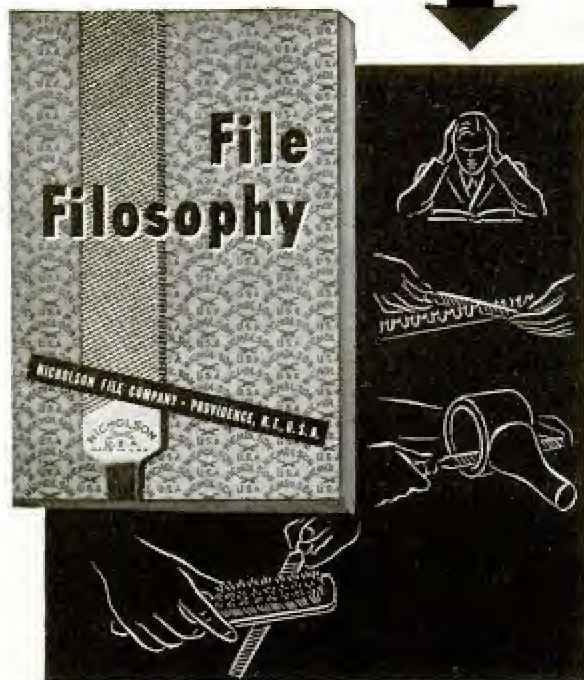
G-E MAZDA LAMPS

GENERAL  ELECTRIC

INVEST IN YOUR COUNTRY'S FUTURE... BUY AN EXTRA WAR BOND THIS MONTH



"A HOME-STUDY COURSE" for a postage stamp



ARE you a shop foreman, mechanic or mechanical "trainee" who appreciates the importance of sound fundamental knowledge of the proper use, proper care and proper selection of tools?

Start with files and filing—one of the most basic and widely applicable subjects in the mechanical curriculum. If you are in or definitely aiming toward a mechanical career, a postage stamp will bring us your request for

"FILE PHILOSOPHY"

—the most authoritative book of its kind. Widely used in school-shops and shop-schools, "File Philosophy" takes you through the history of files; the way files are designed and manufactured; the kinds, sizes and cuts of files; the purposes and characteristics of many special files. Tells how to use files expertly—on various metals, in sharpening saws and other tools; how to take care of files.

IT'S FREE—this valuable "text-book" of 48 interesting, informative, profusely illustrated pages—a Nicholson contribution to the advancement of American industry and the vast army of trained men who are its back-bone.

NICHOLSON FILE CO., 22 Acorn St., Providence 1, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

Manufacturers of Nicholson and Black Diamond quality files—sold through hardware and mill-supply houses.



carry freight. A true cargo plane, however, is on the way.

More than once the swift couriers of the Air Transport Command have met an emergency that changed the course of the war. Once they played their essential part in saving Egypt. Rommel was at the very gates of Cairo when the British sent a call for help. They were virtually out of anti-tank ammunition fuses. The SOS came to the ATC, and within 72 hours the fuses were gathered up in America and flown across and unloaded on the African desert.

British soldiers, British guns, British leadership beat Rommel. But without the ammunition flown in the nick of time by the U. S. Air Transport Command, Rommel might not have been stopped.

In such vast operations, an accident rate of 44/100 of one percent is amazingly low. That's one accident per 200 planes, and few of these keep a plane out of service long.

The Air Transport Command is one reason why your gasoline is being rationed. Its fuel consumption must be a military secret, but it is unimaginably enormous.

Today the tremendous fleet of thousands of Air Transport Command aircraft is carrying ten times as much material, and ten times as many passengers, as all the air lines of the world before the war.

Hitler's 500-Acre Headache

(Continued from page 5)

70,000. There are 50 miles of water and gas mains, 500 miles of telephone wire.

Compared with this impressive plant, the engine it produces seems unbelievably simple and insignificant at first glance. It is only when one follows the intricate steps in the creation of this modern miracle that one appreciates its production problems.

At one end of the plant is the forge shop for the heavy parts that go into the engine. Here red hot blocks of steel are beaten and squeezed into shape by giant hammers. The concrete bases that support the blocks under the hammers have piles that go down to bed rock. The dies that shape the thousands of parts are made in the die shop, and the hard steel tools for cutting the dies are made in a nearby tool shop.

In twin units, each of which would be considered a major industry in its own right in normal times, castings of aluminum and magnesium are made. The world's largest magnesium castings are poured in the magnesium foundry. If one of these big castings were made of steel, it would be more than a man could budge; as it is, it can be lifted with one hand. It doesn't take

(Continued to page 162)



RAINBOW IN THE SKY

There is good news in the work of American laboratories. It is a reason for confidence in the war — a promise for the future.

Little is said about our scientists because they labor behind locked doors and their work is secret. But the topside of the German and Japanese armies and navies know about them. Things they do turn up at the front and make life harder for our enemies.

After the war, from these same scientists and their laboratories, will come the things that make jobs, comforts, conveniences and luxuries for the American people. They hold out prospects for good use of the opportunities victory will bring.

The Bell Telephone Laboratories, with some seven thousand workers, are among the many research groups that are devoted to winning the war.

When that is done, Bell System scientists will be back on their old job of making your telephone service, and your human contacts over the distances, easier and better than ever.

BELL TELEPHONE SYSTEM



HELP THE WAR BY MAKING ONLY VITAL CALLS TO WAR-BUSY CENTERS. THAT'S MORE AND MORE ESSENTIAL EVERY DAY.

FOR MEN WHO REALLY KNOW PIPES

Royalton



**Makes a home-body
feel like Somebody . . .**

To enrich your close-to-hearth hours select a Royalton for complete smoking satisfaction . . . The pleasure that a Royalton brings will endure long after ordinary pipes have been laid aside.

Royalton Silver Crown

Choice Grains

\$5



Royalton
SPORTSMAN

Wherever Better Pipes are Sold

© 1943, Henry, Leonard & Thomas, Inc., Ozone Pk., N. Y.

an aeronautical expert to appreciate the importance of this comparatively light-weight part in a bomber engine.

The process of pouring magnesium is one of industry's most colorful operations. The white-hot metal that has a tendency to burst into a pyrotechnical display unless carefully treated is poured into molds made of sand baked as hard as stone. The molds, of course, are also made in the foundry. Before pouring the magnesium, carbon dioxide gas is pumped into the recesses of the mold to remove all air, for the hot magnesium burns on contact with oxygen.

When the large and small castings are broken out of their molds, rough spots are machined away and they are sent along on the network of assembly lines that feed into the main machining and assembly building.

Here the parts that pour from the foundries and forge shops in a never ending stream are cut down, ground and polished on the greatest array of lathes, drills and other finishing machines ever assembled. Metal is ground to specifications measured in hundred-thousandths of an inch.

In this building many of the parts receive a final heat treatment to harden their mirrorlike surfaces. Others are painted and treated with chemicals, and some are even plated with tin, nickel or chrome.

Visitors are taken through the building on a platform trailer pulled by a tiny tractor. Beside each seat is a loud speaker that carries the voice of a company man who sits beside the driver with microphone in hand.

Two-thirds of the main building is used for machining, and a "small" area of about 22 acres is occupied by the sub-assembly, first run, and final assembly lines. This section is air-conditioned to guard against minute expansion or contraction of the metal parts. On the sub-assembly line, the finished parts are gathered and put into a specific piece such as the supercharger, pistons or ignition system.

At the end of the first run line, the engine is lifted from the assembly dolly and placed on a test mount designed to speed the transfer to a test cell, and the job that once took hours is accomplished in a few minutes. In the cell, a generator instead of a propeller is attached to the shaft and the energy is used to make electricity.

After the first test, the engine is completely taken apart and each part is minutely examined. If any defects show up, new parts are substituted before the second assembly begins on the final line.

Workmen have nicknamed the plant "Hitler's Headache." One of these days the engines they are building will be roaring over Berchtesgaden.



"FIRE BOMBS FALLING ... Rush the Pumpers!"

It's a forward base for the big push . . . and the Japs know it. They're trying to burn us out. For a while it seems we have more fires than we can handle . . . that is, till the fire pumpers arrive. They're hauled by anything that will pull! They unlimber and go into action like artillery. Fire just hasn't a chance with them around!

Nearly anybody can operate a Chrysler War Emergency Fire Pumper . . . Originally developed to meet an acute shortage of fire equipment in areas vulnerable to air raids, they had to be simple and easy to use. Thousands of them now augment our regular fire departments in all parts of the country. They've proved so compact and

mobile that many more have been sent into service at our advanced bases overseas.

The Fire Pumper is built around the same sturdy, dependable engine used to power thousands of cars manufactured by Chrysler. The engine with its moving parts Super-finished mirror-smooth—some to one-millionth of an inch, for quietness, economy and longer life.

Such Chrysler wartime developments demonstrate the pioneering leadership of Chrysler Division.

BACK THE ATTACK—
WITH WAR BONDS

CHRYSLER



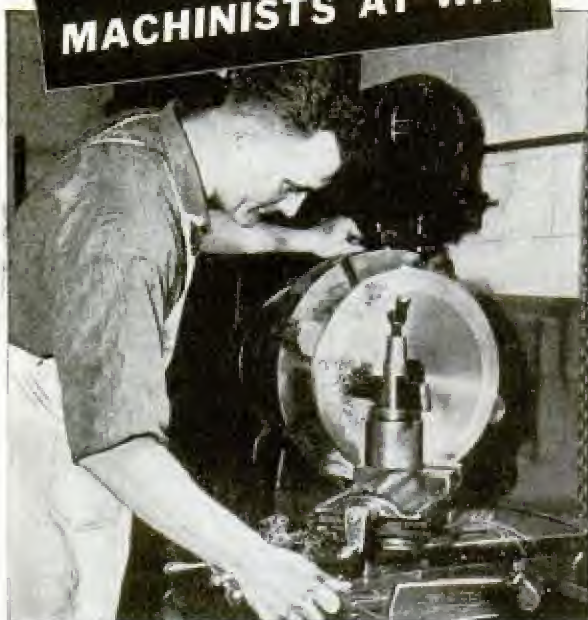
DIVISION OF CHRYSLER CORPORATION

WAR PRODUCTS OF CHRYSLER DIVISION

Industrial Engines • Marine Engines • Marine Tractors • Navy Pontoons • Harbor Tugs • Anti-Aircraft Cannon Parts • Tank Engine Assemblies • Airplane Wing Panels • Tank Parts • Fire Fighting Equipment • Air Raid Sirens • Gun Boxes • Navy Searchlight Reflectors.

THE NATION-WIDE CHRYSLER DEALER ORGANIZATION
OFFERS OWNERS SERVICE FACILITIES TO MEET
THEIR WARTIME TRANSPORTATION NEEDS

TOOLS FOR MACHINISTS AT WAR

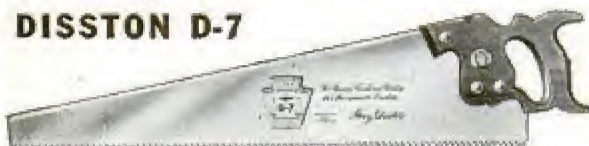


The manufacturing might of all America is concentrated on producing for victory. In the front rank of this vast industrial army are the machinists—and their weapons are tools!

In plants everywhere throughout the nation machinists are busy at every phase of their craft—helping to turn out more, faster, with tools by Disston. Some of the machinist's tools supplied to industry by Disston are the files used every day in general machine shop work, Superfine Swiss pattern files for precision work, file cards, hack saws, hack saw blades, metal cutting hand saws, metal cutting band saws, solid and inserted tooth metal cutting circular saws, metal cutting sabre blades, tool bits, machinist's chisels and others.

● If you need a hand saw for essential war work, see your Hardware Dealer about

DISSTON D-7



Lightweight Straight-back pattern. Universally popular, moderately priced, Disston quality. Made in 26-inch 7, 8, 10 and 11 points cross-cut, $5\frac{1}{2}$ points rip.

KEEP TOOLS WORKING with the help of the Disston Saw, Tool and File Manual—FREE from your Hardware Dealer . . . or write for a copy.

HENRY DISSTON & SONS, INC.

1111 Tacony, Philadelphia 35, Pa., U.S.A.

PALMGREN ANGLE VISES

for
Drilling
Milling
Grinding
Fitting
Filing



Solve Difficult Angle Jobs

Quick, accurate setups at any angle. End makeshift methods—time loss—rejections. Ideal for tool rooms or home workshop. Accurately machined and graduated. Once set, it stays locked. Jaws hardened steel—plain or grooved. Sizes $1\frac{1}{2}$ " to 8" Jaws. Orders filled on plant priority ratings only. You may qualify. Write, Chicago Tool & Engineering Co. 8365 South Chicago Ave. Chicago, Ill.

FREE CIRCULAR—of ANGLE OPERATIONS—describes complete line, gives many uses and details of CASH PRIZE AWARDS

PRECISION WORK AT ANY ANGLE

PROTECTION FROM RUST

TOOLS — GUNS — LOCKS, Etc.

For years hunters have used Fiendoil to keep their guns clean and free from rust . . . equally effective on all metal articles.

At Your Sports or Hardware Store

In 35c, 2 oz. Bottle

FIENDOIL

McCAMBRIDGE & McCAMBRIDGE CO. Baltimore

New OTTAWA WOOD SAW

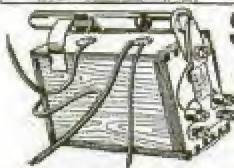


For Tractors

—Makes wood sawing fast and easy. Can cut enough wood to pay for itself quickly. Easily moved while attached. Big heavy blade, FREE details.

LOW PRICE

OTTAWA MFG. CO. 12127 Oak Ave., Ottawa, Kans.



SELL ELECTRIC FENCER

The New HIRSH FENCE KIT is the best yet. Sell dealers or direct. Salesmen make up to \$188.44 per gross. Good territory open. 2 Samples, \$3.00.

LEJAY MFG. CO.

2947 Lejay Bldg., Minneapolis, Minn.

TRAILER AXLES, HITCHES, AND PARTS

● If you are interested in purchasing trailer axles, hitches, and other trailer parts, contact us promptly. Complete house trailer blue prints, \$1.00. Write for free literature.

HAMMER BLOW TOOL COMPANY, Dept. 111, WAUSAU, WIS.

MOTORISTS Wanted!



TO MAKE THIS UNIQUE GAS SAVING TEST

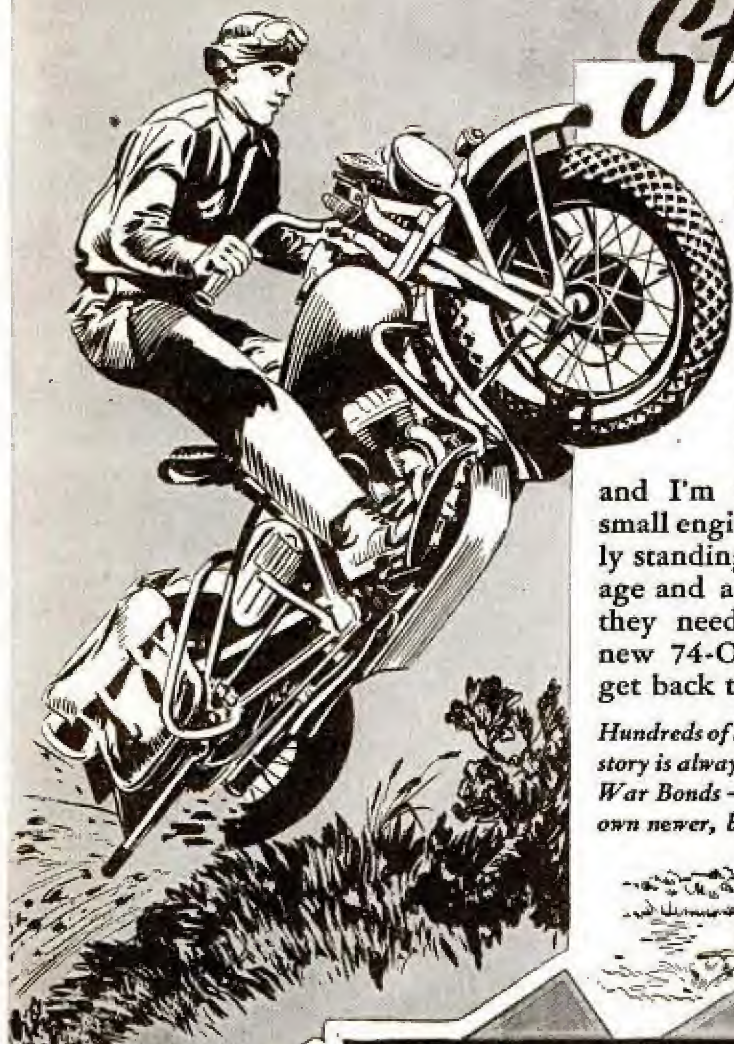
Will you permit us to send you at our risk the Vacu-matic, a device which auto owners everywhere are praising? Install it on your car. Test it at our risk. Unless it trims dollars off your gas bills by saving up to 30% on gasoline consumption, gives more power, quicker pickup and faster acceleration, the test will cost you nothing.

Automatic Supercharge Principle Vacu-matic is entirely different! It operates on the supercharge principle by automatically adding a charge of extra oxygen, drawn free from the outer air into the heart of the gas mixture. It is entirely automatic and allows the motor to "breathe" at the correct time, opening and closing as required. Saves up to 30% on gas costs, with better motor performance.

AGENTS Get Yours FREE

FOR INTRODUCING. Here's a splendid opportunity for unusual sales and profits. Every car, truck, tractor owner a prospect. Send name and address now for big money making offer and how you can get yours Free. The Vacu-matic Co., 7617-845 W. State Street, Wauwatosa, Wis.

Harley-Davidsons are Really *Standing Up!*



On all war fronts, the men who ride and service Harley-Davidsons are learning what "dependable performance" really means. You can't beat tough war action for proving that Harley-Davidsons can "take it and dish it out."

One fighter wrote from (CENSORED): "We're in an ordnance maintenance outfit and I'm overhauling trucks, cars and small engines. Harley-Davidsons are really standing up. They get twice the mileage and abuse other vehicles get before they need attention. I intend to get a new 74-OHV Harley-Davidson when I get back to the good old U. S. A."

Hundreds of these letters continue to pour in—and the story is always the same. Put your fighting dollars in War Bonds — and join the riders who are going to own newer, better Harley-Davidsons after the war!



HARLEY-DAVIDSON MOTORCYCLES

HARLEY-DAVIDSON MOTOR CO.
Dept. P, Milwaukee 1, Wisconsin

Please send at once free copy of 24-page "Enthusiast" Magazine, filled with motorcycle action pictures and thrilling stories.

Name

Address

City State



**SEND COUPON
NOW**

FREE!

THIS IS THE WHEEL, MR. JONES



Maybe you were stumped by grinding jobs before, but they won't worry you any more.

300 shapes and sizes—every grade and grain—there is a Chicago Mounted Wheel custom-built to take on any grinding problem. Each

wheel is a whirling point of power that turns your jobs out smooth—and in a hurry.

PROMPT DELIVERY—Our wartime set-up concentrates on mounted points and grinding wheels 3" in diameter and under. Production is stepped up and keeps pace with demand.

Handee Tool of 1001 Uses and Hi-Power Grinders are still available to all who have priorities.

Send for Free Catalog

CHICAGO WHEEL & MFG. CO.
108 S. ABERDEEN STREET, CHICAGO 7, ILLINOIS



Mortite UTILITY TAPE

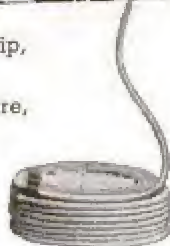
BETWEEN YOU and THE COLD

New pliable plastic stops leaks, saves fuel. Weather-strips windows, doors, baseboards—caulks casements; makes packing, gaskets.

Easy to apply. Unrolls like ribbon. Just press into place and it stays put. Does not crack, chip, dry out or shrink.

About 80 ft. to a box. At Hardware, Plumbing, Mill Supply Dealers or \$1.25 prepaid (\$1.40 west of Rockies).

Send for Circular



STOPS THAT DRIP

A sure cure for condensation drip from tanks, pipes, walls, ceilings, etc. Apply with brush, trowel or spray. At stores or \$1.90 for 1 gal. prepaid (\$2.10 west of Rockies). Free Circular.

J. W. MORTELL CO., 522 Burch St., KANKAKEE, ILL.

Say you saw it in Popular Mechanics!

PRECISION GAGE BLOCKS

Indispensable in interchangeable manufacture, in testing and setting tools, in checking micrometers, U L T R A-CHEX are now available in one block sets as illustrated.

Every toolmaker and mechanic can now afford his own set of gage blocks. Order now to turn out highly precise work, reduce rejections, save material.

The ULTRA-CHEX set consists of the following blocks: .0025", .100", .125", .200", .250", .300", .500", 1", 2", enabling you to make up 331 combinations.



BECOME A BETTER CRAFTSMAN BY ORDERING ULTRA-CHEX NOW!
Price with optical flat... \$27.50 Price without flat... \$19.50

ASK FOR NEW FOLDER "THE USE OF GAGE BLOCKS"
GEORGE SCHERR CO. 128A Lafayette St. New York, N. Y.

Speed Welding Production

with Steel-Grip one-piece-backwelders' gloves

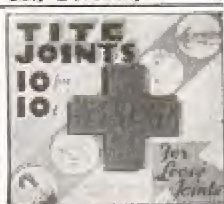
Specially designed Steel-Grip Welders' Gloves give extra protection against heat and wear. Keep production "rolling." Entire back cut in one piece from special tanned heat-resistant leathers. No seams in back. No burned-through or ripped seams. Wool heat breaker lining inside back for added protection. Finger seams welded at points of greatest wear. Widespread thumb reinforcement. Try a pair. Only \$1.85. Outlast other gloves. Order No. 13475 now from jobber or direct, 10% discount on 12 pair lots. Write for welders' clothing catalog.



INDUSTRIAL GLOVES COMPANY
651 Garfield Boulevard Danville, Illinois
(In Canada: Safety Supply Co., Toronto)

FIX THAT WOBBLY CHAIR IN 1 MINUTE FOR 1¢

Get TITE JOINT, amazing new fabric cross impregnated with powerful adhesive. Tightens chair rungs, table legs, drawer pulls, umbrella handles, other loose joints. Just wet, place over end of loose dowel, and push into socket. Cements itself to wood; is there to stay! Department, hardware, chain stores. . . . Wholesalers' inquiries invited.



TITE JOINT SALES CO., 309 5th AVE., NEW YORK 16, N. Y.

110-VOLTS AC from DIRECT CURRENT

with KATO CONVERTERS. Furnish standard 110-v AC from 32, 110, or 220-v. DC. Good deliveries on sizes 350 through 1500 watts on priority orders.

Good deliveries on 5, 7½, 15 & 25 KW AC generators. Mfr's of motor generators, frequency changers and high frequency generators.

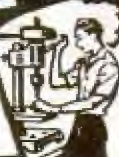
KATO ENGINEERING CO.
32 Elm Street, MANKATO, MINN., USA



LUBRICATES • CLEANS • POLISHES • PREVENTS RUST

3-IN-ONE Heavy Body OIL

PROTECTS LIGHT MOTORS



At Hdwe., Drug, Grocery and 10¢ Stores

POPULAR MECHANICS



What kind of "window blinds" do you want for your home after the war?

TELL US...YOU MAY WIN \$200.00* IN WAR BONDS OR ONE OF THE 41 OTHER PRIZES, TOTALING \$500.00

WHAT HAS BEEN DONE



Many years ago, window drapes and shutters were used to regulate light and give privacy.

About 1864, the spring roller for cloth shades was perfected. Since then there have been few changes in this roller, or in cloth shades.



Fifteen years ago, CLOPAY perfected and introduced cellulose fiber window shades which looked like expensive cloth shades, but cost about 1/5 as much.



Then women asked: "Why can't you make a shade to attach to our old rollers so we can afford to put up fresh, clean window shades every year?" So CLOPAY invented the gummed strip which makes it easy to attach a new CLOPAY shade to an old roller—without tacks or tools. These "refill" shades still sell for 10c, 15c—with lovely washable ones for only 29c.

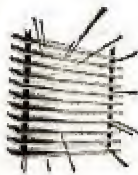


Next, Venetian Blinds for all. CLOPAY developed Venetians with sturdy, curved fiber slats that look like the smartest steel and wood Venetians. They cost about half as much — \$1.69 to \$2.19.

What's your pet window shade peeve? How would you remedy it? What gets your goat about Venetian Blinds? How would you improve them? Have you a brand-new, bright idea about window blinds?

WHAT MIGHT BE DONE

For instance, you may have an idea for a window shade that pulls from side to side. Such a shade could be made.



Or, perhaps you'd like a Venetian Blind with slats of glass or some other material. Maybe you have an idea for an entirely new kind of slatted shade.

How about an accordion-type blind—one that lets down from the top, or pulls up from the bottom?



Let's have your ideas and suggestions for the window blinds CLOPAY is planning for the brighter homes of tomorrow. And even the simplest thought may win one of the 42 prizes. It may be a suggestion for a new pattern, color or material...an idea for improving wearability...a new way of hanging, pulling or adjusting. Read the easy rules and get busy this very minute.

CLOPAY CONTEST RULES

1st Prize\$200 in War Bonds*
2nd Prize\$100 in War Bonds*
Next 40 Prizes...Each, \$5 in War Stamps

1. Write a letter telling us what you think is wrong with window shades or Venetian Blinds; what changes you would like after the war. Suggest, if you can, how these improvements might be made. Or briefly explain any brand-new idea you have for window blinds. Write plainly, on one side of paper only.

2. Mail your entry to CLOPAY Corporation, 1278 Clonay Square, Cincinnati 14, Ohio. All entries must be mailed no later than midnight, December 31, 1943.

3. Entries will be judged on the basis of originality of idea, state, and local laws Penmanship or fancy

entries will not count extra. Decision of judges will be final. In case of ties, duplicate prizes will be awarded, but where suggestions are similar, prize will be awarded to entry explaining it most clearly and interestingly.

4. No entries will be returned. All entries, ideas and contents thereof become the property of the CLOPAY Corporation.

5. This contest is open to any resident of the United States or Canada, except employees of the CLOPAY Corporation or its advertising agency and their families, and is subject to all Federal, state, and local laws and regulations.

*Maturity value.

CLOPAY WINDOW SHADES

On sale at 5-&-10c and neighborhood stores everywhere.



No. GA121—This watch can go places—sturdy, anti-magnetic, precision tested, 15-jewels. Has radium dial and hands, non-breakable crystal, waterproof strap, sweep second hand and stainless steel back. **SHOCK-RESISTANT. \$39.75**

No. GA328—Same, 17 jewel, SELF-WINDING, SHOCKPROOF. **\$59.75**

Attractively Boxed. Prices include Federal Tax, Postage Prepaid.

Write for Free Illustrated Booklet "GA" MAIL ORDERS PROMPTLY FILLED

BELL WATCH COMPANY

Time and Life Bldg., Rockefeller Center, New York, 20, N. Y.

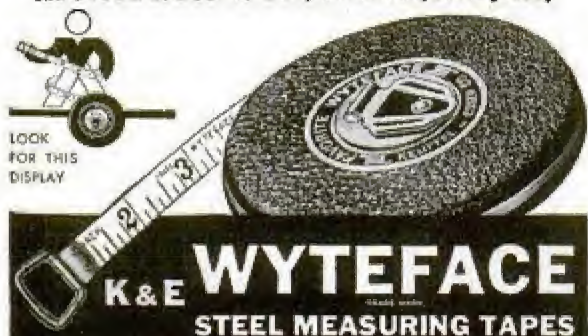
"I'LL TAKE THE WHITE ONE EVERY TIME"



... EASY TO READ

—easy to clean—unconditionally guaranteed for one year. The crack-proof white surface is bonded to the steel—protects it from rust. 25, 50, 75, 100 ft. lengths. Sold by hardware, building material, mill supply dealers everywhere. Write for folder.

KEUFFEL & ESSER CO., Hoboken, New Jersey



K&E WYTEFACE
STEEL MEASURING TAPES

Say you saw it in Popular Mechanics!



Want a cheery fire, fast? Light a **HEATAB!** Wet or dry it gives instant flame, long-burning, intense heat... outdoors, indoors, for cooking, camping, picnics, hunting, fishing, starting furnace, stove or grate fires. Countless other uses by housewives, doctors, nurses, dentists, chemists, industrial workers, Boy Scouts, Girl Scouts, Red Cross and Civilian Defense workers. Needed in First Aid and Emergency Kits. Carried by armed forces to heat combat rations. Solid, compact, non-poisonous. **NO SMOKE, SOOT, FUMES or ASH!**
SPECIAL OFFER: COLLAPSIBLE STOVE (fits vest pocket) included with TWO LARGE BOXES of HEATABS... only \$1.00 postpaid... ORDER BY MAIL, TODAY!

J. W. SPEAKER CORPORATION
1673 N. Water Street Milwaukee, Wis.

"HEATAB" TABLETS OF HEAT

Land or Water "DUCKS" know their Way



HULL MFG. CO., P. O. Box 246-D11, WARREN, OHIO

PAINT STRIPING TOOL **ONLY \$1.00 POST PAID**

Try it! See the Added Beauty

With this NEW TOOL (not a brush) everyone can now draw lines with paint. Used on autos, models, toys, tiled walls, cabinets, furniture, linoleum floors and all home workshop projects.

As easy to use as a pencil



Send only \$1.00 for complete tool for painting a 1/16" wide stripe, including adjustable guide, operating instructions, etc. Co. G. 13 price \$1.25. Tool uses paint, enamel, lacquer, etc. Patented interchangeable tips are available for wider or narrower stripes.

Every Painter and Craftsman Should Own One. Send for your tool today. Use it. If you are not satisfied that you have added character as well as beauty to your work, return the tool and we'll refund your money promptly.

Dealer: Write for literature, etc.
WENDELL MFG. CO.
2531 N. Ashland Ave. Chicago, Ill.

MAKE BIG MONEY SAWING WOOD NOW!



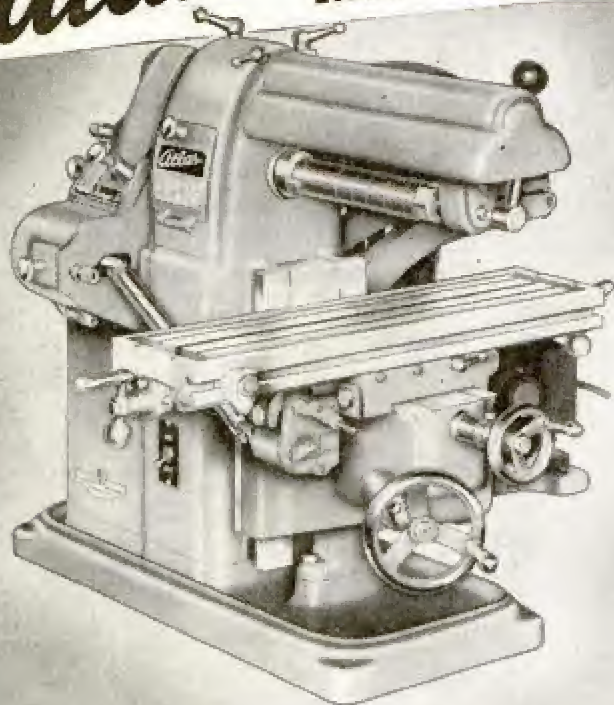
OTTAWA ONE-MAN TRACTOR SAW

Turn wood lots into cash; help save other fuels to win the war. Use Ottawa—fastest cutting; easiest way. Cuts large and small logs, fells trees. Thousands in use. Built to last with special heavy stiff saw blade. Positive safety clutch control, driven from any power take-off.
OTTAWA MFG. CO., D-1127 Forest Ave., Ottawa, Kansas

FREE BOOK and Price List

POPULAR MECHANICS

Atlas MILLING MACHINE



ON EVERY FRONT WHERE PRECISION COUNTS

Millions of dazed Germans fleeing devastation from the air . . . captured Nazi supermen cowed and begging to see our "automatic cannon" . . . Jap warships sunk in pitch black night, out of sight but not out of reach — such military miracles are tributes to the American ingenuity and the production ability of American industry.

We're proud that in thousands of war plants, and in the mobile machine shops of our armed forces, compact modern Atlas machine tools are picked for the precision work that helps make such victories possible.

Typical of Atlas development for war production is the Milling Machine — shown above — first low cost bench milling machine. It handles the full range of milling on small parts, relieves larger machines of such work, and maintains precision production day after day. It's a good tool to remember for your post-victory shop.

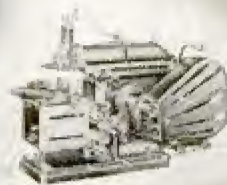


ATLAS PRESS COMPANY

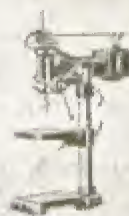
1143 NORTH PITCHER STREET, KALAMAZOO 13D, MICHIGAN



LATHES



SHAPERS



DRILL PRESSES

★ BUY WAR BONDS NOW ★

FOR A NEW *Atlas* SHOP
AFTER THE WAR

HOW TO CHOOSE A GLUE

Don't think that there is any *one* glue that does all gluing jobs. Here are two simple rules to follow.

RULE 1

USE CASEIN GLUE: For all interior or protected construction—furniture, cabinets, toys, laminated trusses and beams, interior wall panels and all types of "odd jobs".

REASON: Casein Glue (CASCO) is easier, more fool-proof to use than resin. CASCO is "self-bonding," needs only moderate, not extreme pressure. Has "filling action" on poorly fitted joints. Highly water-resistant, withstands any interior conditions except extreme dampness or mold. Used at any temperature (above freezing).

RULE 2

USE RESIN GLUE: Where a waterproof, moldproof or stainfree glue is required—boats, outdoor furniture, screens, in damp basements, on thin veneers, etc.

REASON: Resin Glue (CASCAMITE) is completely waterproof, moldproof, stainfree. (Resin glue requires well-fitted joints, smooth wood surfaces, positive clamp pressure and workroom temperature of at least 70°F.)



CASCO Powdered Casein Glue

Meets Army, Navy and Federal casein glue specifications. Highly water-resistant. Cold water mix. 10¢ to 65¢ at hardware stores.



CASCAMITE Powdered Resin Glue

The same type of glue used for Army and Navy life floats, truck bodies, other field equipment. Mixes instantly in cold water. 10¢ to 85¢ at hardware stores.

FREE GLUING GUIDE AND PROJECT BOOKLETS

CASEIN COMPANY OF AMERICA! Dept. PM 11
350 Madison Avenue, New York 17, N. Y.

Send me the literature checked.

- ☐ "GLUING GUIDE". Complete directions for both glues. Over 80 home workshop jobs.
- ☐ "CASCO PROJECTS". Describes 24 furniture projects by famous American designers. How to get free plans.
- ☐ "CASCAMITE WATER PROJECTS". Describes 12 new boat and water projects by Wm. F. Crosby. How to get free plans.

NAME _____

ADDRESS _____

----- Save 2¢ - Stick coupon on penny postcard -----



ONAN

ELECTRIC PLANTS

Electricity for Any Job - Anywhere

ONAN GASOLINE DRIVEN ELECTRIC PLANTS provide electricity in locations where it is not otherwise available, and for emergency standby service. Thousands of units are doing a winning job in the war.

Sizes from 350 to 35,000 watts.
A.C. 50 to 800 cycles, 110 to 660 volts.
D.C. 6 to 4000 volts. Also dual A.C. and D.C. output models.
Air or water cooled.
Details gladly furnished.

D. W. ONAN & SONS

1087 Royalston Ave. Minneapolis, Minn.



GET THIS BOOK — the only one of its kind. Full of detailed drawings and photographs with instructions for building and rigging ship models. **SHIP MODELS ILLUSTRATED** postpaid for only \$2.

MARINE MODEL CO., Dept. M-2, 29 W. 15th St., N.Y.C.

BUILD THIS MODEL

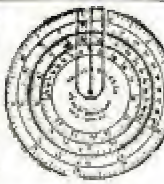
An accurate 13" scale model of the famous PT. Complete kit includes all fittings — Only \$5.



MASCOT SLIDE RULE

- Fits the pocket. Quickly solves any problem in multiplication, division, proportion. Gives the square, the square root, logarithm and reciprocals of all numbers. Trig scales give sines and tangents of numbers. Fine black graduations on white celluloid. Price in fabricoid case \$1.00, in leather case \$1.25. Money back if not satisfied. Special offer to agents and dealers.

TAVELLA SALES CO., 19 West Broadway, New York, N. Y.



HOLD-E-ZEE

Automatic Grip Screwdrivers

Hold, start and set-up screws in unhandy places. Gripper instantly released by spring action sliding up out of the way when not in use. Fine materials throughout, high quality blades; many have transparent, insulating, unbreakable handles. Models for recessed-head screws. No more expensive than ordinary screwdrivers. At hardware, auto-supply, or electrical stores.



UPSON BROS. INC.
85 Exchange St.
Rochester, N. Y.

New Designs in FRANZITE GRIPS

Modernize Your Gun! Improve Your Score!
Most durable grips made. Positively unbreakable! For Colt, Smith & Wesson, Hi-Standard, Origen, Luger & Mausers in a wide choice of beautiful designs in ivory, pearl, walnut, onyx, etc. Low prices. **FREE CATALOG.** Dealers Wanted.

SPORTS, INC., (Mfrs.) 2850 N. Clark St., Dept. P-11, Chicago, Ill.



CHEMISTRY CATALOG 7,000 ITEMS

Everything for the study of Science, Chemistry and Biology. Send 25¢ for our BIG Catalog describing 7,000 items including materials and apparatus for every scientific need.

STANDARD SCIENCE SUPPLY COMPANY
1234 North Paulina St. Chicago, Ill.

**Only
25¢**

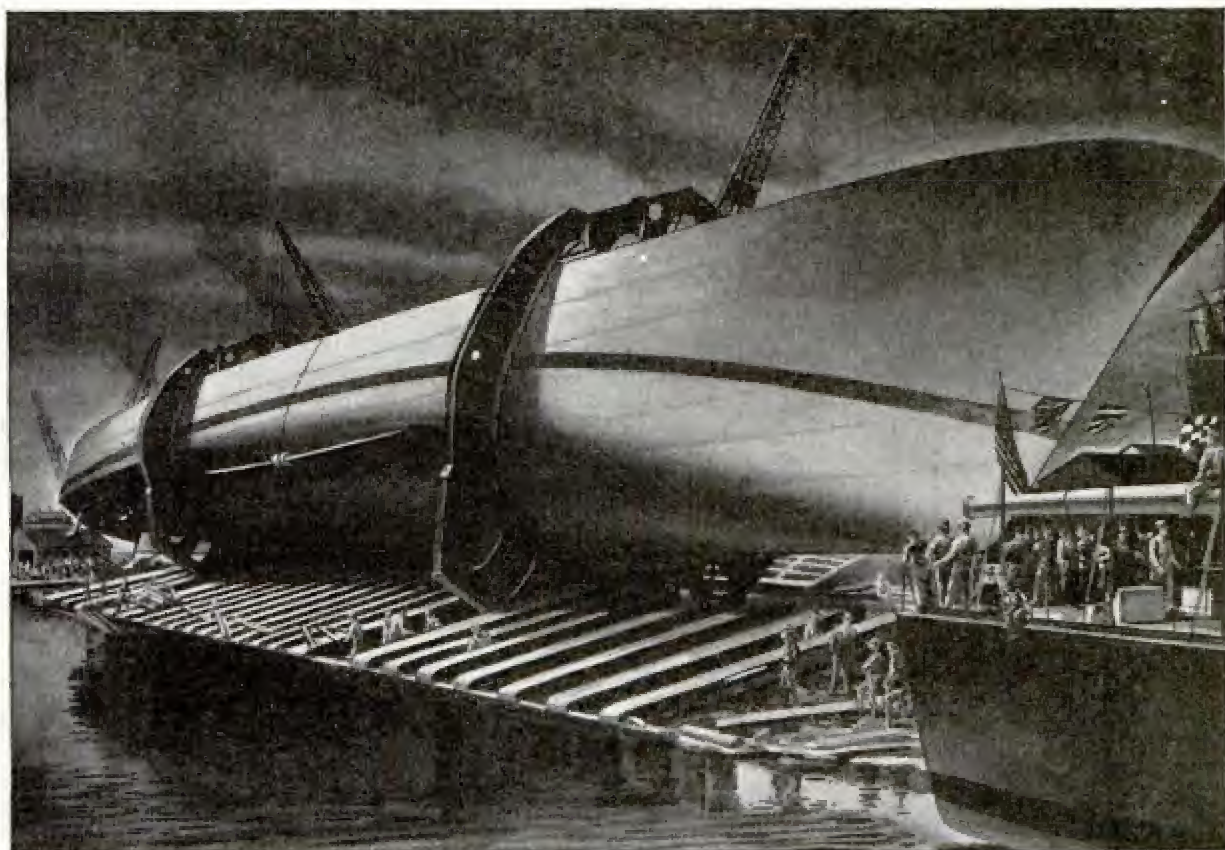


DECORATIVE Decalcomania Transfers

Imported Designs of all Sizes and Types—Flowers, Fruits, Birds, Dogs, Horse Heads, Ships, Juvenile, Tropical, Chinese, Peasant, Inlay, Initials, etc., for Furniture, Doors, Walls, Trays and what not.

Catalog with 800 illustrations in color sent for 25¢ Deductible on first purchase of \$1.00 up.

L. C. WELLS, Dept. PM-311, 25 E. 26th St., New York



750 Ton Flapjack!

HISTORY was made when the destroyer escort, U.S.S. *Bunch*, was "rolled over" successfully at the Defoe Shipbuilding yards at Bay City, Michigan. For this was the first time a steel-welded ship more than 300 feet long and weighing over 700 tons had been built upside down.

The same engineering feat that made it possible to build the U.S.S. *Bunch* in record time is producing an ever increasing fleet of sister ships—many of which are already in service with the Navy on the high seas.

Defoe's unique "flapjack trick" with ocean-going warships does away with conventional ship scaffolding and allows workers to stand over their job at all times. Defoe con-

struction methods deliver *twice the production per man hour* resulting in *double the number of ships built at half the labor cost per vessel.*

Resourcefulness in developing new methods and shortcuts to speed delivery of ships to the Navy is typical of Defoe engineering tradition. And when our fighting men and their allies have dealt a knockout to the Axis, the same competitive spirit, skilled workmanship and "know how" that are now setting records in producing for Victory, will be reflected in even greater values of Defoe products to serve peacetime America.

★ ★ ★

BACK THE ATTACK—BUY WAR BONDS
Defoe workers take more than 10% of their pay in War Bonds

"Next to our immediate task of building warships faster and faster, the first responsibility of Defoe is to plan for post-war operation that will provide the maximum of gainful employment."

HARRY J. DEFOE
Founder Defoe Shipbuilding Co.

DEFOE SHIPBUILDING COMPANY, BAY CITY, MICHIGAN

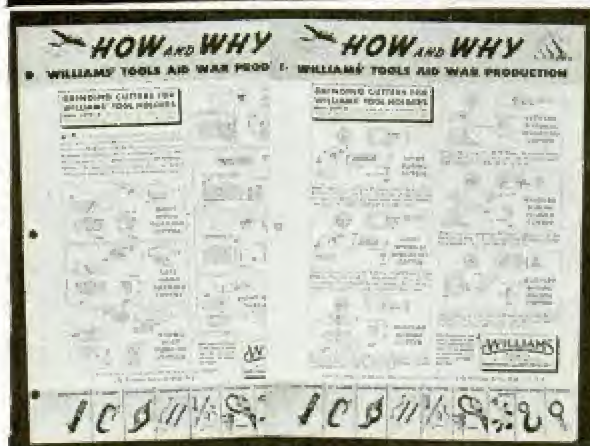
Defoe



Three White Star Renewal Citations now decorate the Navy "E" Award won by Defoe workers.

**Ships for Victory
Servants for Peace**

HOW TO GRIND CUTTERS FOR WILLIAMS' TOOL HOLDERS



FREE! WILLIAMS' TOOL DATA SHEETS

These two Williams' Tool Data Sheets graphically explain how to grind cutters—give correct included angles, clearances and rakes. Also instructions for set-up and use. Other Data Sheets are listed below. Circle the number of those desired on coupon and mail today. They're punched for 3-ring binder.

- | | |
|--|--|
| 1. Characteristics of Williams' "Superior" Wrenches. | 9. Saving Time with Williams' "Supersockets" |
| 2. Data on Williams' Boring Tools. | 10. Data on "Vulcan" Eye Bolts. |
| 3. Data on "Vulcan" Chain Pipe Tongue. | 11. Data on Williams' "C" Clamps. |
| 4. Data on Williams' "Supersocket" Wrenches. | 12. Use of Williams' Cutting-Off Tool Holders. |
| 5. Data on "Vulcan" Lathe Dogs. | 13. Use of Williams' Knurling Tool Holders. |
| 6. Data on "Vulcan" Chain Pipe Vises. | 14. Use of Williams' Threading Tool Holders. |
| 7. Data on Williams' Turning-Tools. | 15. Internal Threading with Williams' Tools. |
| 8. Data on Williams' "Superior" Wrenches. | 16. How to grind Tool Holder Cutters. Sheet A. |
| 17. How to grind Tool Holder Cutters. Sheet B. | |

MAIL THIS COUPON

J. H. Williams & Co., Dept. M-1143, Buffalo 7, N. Y.
Please send Data Sheets circled below:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

Name _____

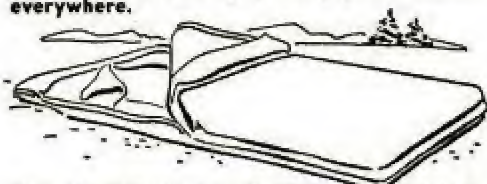
Address _____

City _____ State _____

WILLIAMS
SUPERIOR DROP-FORGED TOOLS



DEFIES COLD! New methods of treating outer coverings to increase resistance to dampness, new construction of openings to seal out icy winds—these are some of the war-born features you will have in your after-war Ta-Pat-Co. Entire production is now going to our armed forces, but when peace returns you'll find this fine sleeping bag and other Ta-Pat-Co equipment at leading sporting goods dealers everywhere.



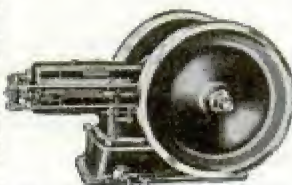
THE AMERICAN PAD & TEXTILE COMPANY
GREENFIELD ★ OHIO

In peace and in war, the leading manufacturer
Of Life-Save Equipment and Sleeping Bags

WITTE DIESEL ENGINES

The WITTE Plant is producing large numbers of Diesel Engines and Dieselectric Plants exclusively for the War Effort.

They are helping to speed Victory on many fronts the worldover, and when victory comes these same improved WITTE units will be available to all.



Remember us then. Slow Speed Heavy Duty

WITTE ENGINE WORKS

LARGEST BUILDER OF SMALL DIESELS
KANSAS CITY, MO., U. S. A.

POLISHING AND BUFFING KIT



For Household and Home-craft
POWER BUFFING KIT

Contains 4 types buffing compound, quickly polish silverware, chrome, brass, iron, copper, aluminum, gold, plastics, etc.

SEND NO MONEY Complete Kit with free 4" buffing wheel sent COD for but \$1.00 plus few cents postage. If you send \$1.00 with order we pay postage.

FREE One full sized 4" buffing wheel free with your order.

BUFF SERVICE AND SUPPLY COMPANY
DEPT. 10, 3129 W. LAKE ST. CHICAGO, ILLINOIS

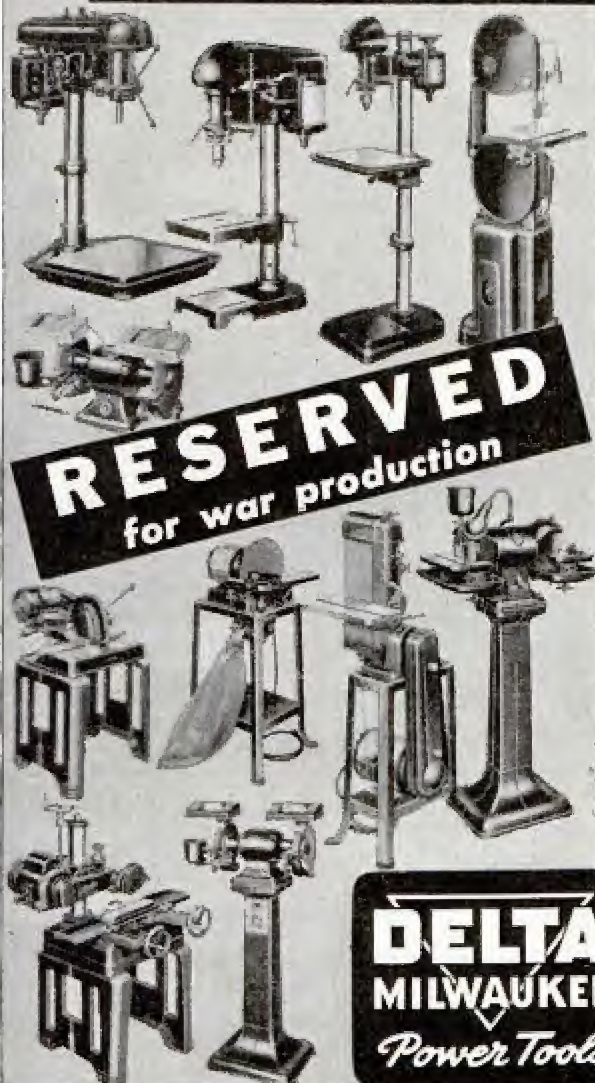
Say you saw it in Popular Mechanics!



Here's how you can plan now for

More Fun and more Profit - with DELTA POWER TOOLS

..in your after-the-war home workshop



Get ready for exciting adventures in homecraft with the great new tools that are coming!

You can start today to lay the ground-work for a shop that any home craftsman might envy. A shop where you can do things you hardly thought possible — using the new Delta Power Tools that are on the way — finer, faster, safer, better-looking than *any* pre-war tools.

As we make thousands of Delta Tools for vital war work, we add to the "know-how" that has already established Delta Tools as the finest in the field. *You* get the benefits, as you create objects that are more beautiful and more saleable, and do it with greater ease, greater safety, and greater pride than ever before.

HM-4

3 things to do NOW . . .

Though Delta's entire output today is needed for war work, there are three steps you can take now to assure the maximum of enjoyment, healthful recreation, and earnings from your post-war workshop.

1. Get Delta's help in planning
Below you see "How to Plan a Home Workshop," a 56-page book to help you in laying out and equipping an efficient, attractive home workshop. It's packed with practical ideas. It gives you "how to" information on dozens of subjects, from Shop Layout to Tool Racks.

Let this book help you save time and money, avoid waste of effort and materials. Use the coupon below and send for it today.

2. Build cabinets, accessories
Get ready for the day of "full production." Tool racks, cabinets, storage racks and other equipment can be prepared. Use ideas from the book below.

3. Buy War Bonds with a goal
Decide on the power tools you want. Then "ear-mark" your War Bond purchases and make your dollars work *two ways* for future happiness.

Only 25¢ "How to plan a Home Workshop." 56 pages of practical, tested ideas and helps — pictures of typical shops — plans, designs, layouts. Fill out coupon below and send it with 25¢ in stamps, check, or money order.



Tear out and mail coupon today

THE DELTA MANUFACTURING CO.
53031 E. Vienna Ave., Milwaukee 1, Wis.

I am enclosing 25¢ for my copy of "How to Plan a Home Workshop."

Name _____

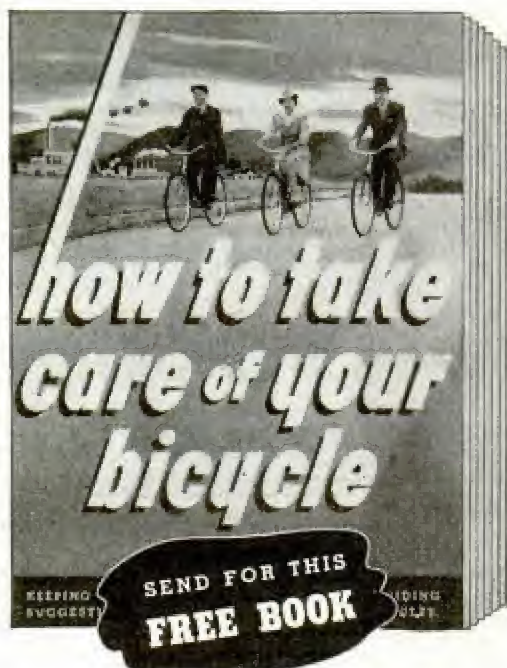
Address _____

City _____ State _____

YOUR BICYCLE

IS WARTIME TRANSPORTATION

... TAKE CARE OF IT



War workers—civilian defense workers—scouts—messengers—students! Here is complete, reliable information for keeping your bike in shape, no matter what make it is. Practical pointers for repair, for safe, comfortable, pleasurable riding—all this information is contained in this handy, colorful, easy-to-read booklet. Ask your Shelby Cycle Dealer for it or:

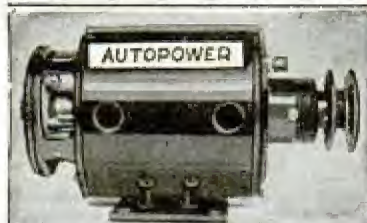
Send postcard with name and address to
DEPT. M, Shelby Cycle Co., Shelby, O.

SHELBY

TRANSPORTATION

Clean out car radiators thoroughly before adding anti-freeze. Use

Sani-Flush 10c and 25c sizes
Directions on can



TURN SCRAP INTO MONEY

AUTOPOWER tells you how in plain, easy, simple, and illustrated instructions that anyone can follow. Change auto generators into useful, practical A C and D C generators and motors with voltage from 2 to 1,000 volts, for power, light, welding, radio, sound, etc. No previous experience nor special tools needed. Generators can be driven by wind, water, fan belt, etc. Already used and endorsed by thousands. Send for your copy of "AUTOPOWER." Only \$1.00 postpaid.

AUTOPOWER, INC.

2125 Pine St., St. Louis, Mo.

POPULAR MECHANICS



SAVE

Valuable
Paint
Brushes!

After every use a DIC-A-DOO PAINT BRUSH BATH keeps bristles flexible, useful, new! DIC-A-DOO Brush Bath will soften and cleanse discarded, hardened brushes—right down to the heel. DIC-A-DOO restores life and service to bristles—does not leave them limp or flabby... 5¢ pkg. cleans several brushes. At paint, hardware and 5 & 10¢ stores, Patent Cereals Company, Geneva, N. Y.—makers of the famous DIC-A-DOO PAINT CLEANERS.

DIC-A-DOO
PAINT BRUSH
BATH



THIS MAY BE YOUR BIG OPPORTUNITY

— An Ohio manufacturer, well rated and with ample financial, engineering, manufacturing, selling and distributing facilities, is interested in additional products for the post-war market. If you have an idea or product on which you need help in development, manufacture, sale or distribution it will pay you to contact this company. If you wish, only the barest details need be given in your initial letter; complete details can be discussed in a personal interview later. An immediate reply may mean the difference between success and failure for you in the coming big post-war market. Write today in confidence to

P. O. BOX 217 STA. C TOLEDO, OHIO

BUILD YOUR GRANDFATHER CLOCK NOW

Send 35c for Simple SHOP TESTED COPYRIGHTED BLUEPRINT. The Simple Grandfather Clock—Cut way as the woods have. DIME, brass PLANK and six picture "HOW" book, giving many fine brass weight Westminster, tube chime movements showing nine beautiful colonial grandfather cases. Build now. Avoid Govt. Freeze. Save half. HURRY! KUEPPEL CHIME CLOCK CO., Bldg. 82, Guttenberg, Iowa





A Lift from the Front at Guadalcanal

FOR all its grimness, modern war is merciful to our wounded. The life-giving miracle of blood plasma*... the swift, efficient treatment behind the lines... plus speedy transport to finely-equipped base hospitals... result in an incredibly high proportion of recoveries among even desperately stricken men.

Speedy Transport! It may be by giant transport plane, by ambulance or nimble-footed Jeep... or at jungle fronts in the South Pacific, by outboard-driven small craft threading narrow rivers, saving priceless hours between front lines and the base.

Evinrudes are busy at innumerable tasks for the Army and Navy, Marine Corps and

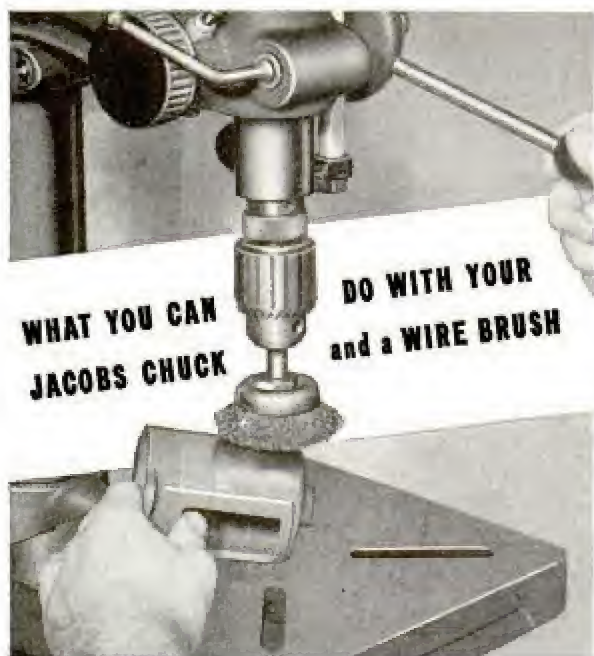
Coast Guard... driving swift assault boats... propelling pontons, lighters, ferries... powering huge rubber rafts, wherries, small craft of every type. *After Victory* there will be peacetime Evinrudes worthy of the traditions of their fighting forebears!

EVINRUDE MOTORS, Milwaukee, Wisconsin
Evinrude Motors of Canada, Peterboro, Canada

EVINRUDE

OUTBOARD MOTORS

**A pint of your blood can save the life of a wounded soldier or sailor. The need is constant, pressing. Call your local Red Cross Chapter for an appointment.*



Hard surface deposits that defy ordinary removal methods quickly give way under the harsh, scratching action of the stiff wire end brush. These brushes, held by the JACOBS Chuck in a drill press or lathe, remove rust, baked-on grease, scale, and paint.

In the photo above a small casting is being burished. Note how the wire brush gives finish to a dull casting. With a softer brush brass, copper, and other non-ferrous metals are given a soft satiny finish.

**If You Have A Drill Press or Lathe,
or Are Planning on
Getting One, You Will Want This Book**

The operation outlined briefly here is one of nineteen covered in detail in our new booklet just off the press. It gives practical, helpful information on unusual and varied uses for drill presses and lathes. Printed in color and containing 49 illustrations, it shows how the set-ups are made, illustrates the tools used, and in some instances tells you how to make the tools themselves. If you have a workshop you will want the valuable ideas this booklet contains. If you are planning on having a shop of your own after the war, you will want the booklet now to help you plan.

10¢

19

UNUSUAL USES

FOR YOUR

DRILL PRESS OR LATHE

Jacobs Chucks

WORLD'S LARGEST PRODUCERS OF DRILL CHUCKS

Jacobs Mfg. Co.
1113 Jacobs Road, Hartford, Conn.

Please send me the booklet immediately
I am enclosing 10¢ to cover handling and
mailing costs.

Say you saw it in Popular Mechanics!

MOVIE MAKERS

\$1500.00 FOR IDEAS

in U.S. War Bonds

8MM CAMERA AND PROJECTOR COMPETITION

You who know what YOU want in the next motion picture camera you buy—what YOU think will simplify and perfect the operation of your postwar motion picture projector—this is YOUR OPPORTUNITY to share \$1500.00 in U. S. War Bonds (maturity value) that DeVry Corporation will award the best and most practical ideas for TOMORROW'S 8MM MOTION PICTURE CAMERA & PROJECTOR. Submit IDEAS in rough or finished drawing—with brief comments if you desire . . . the IDEA is what counts. Write today for details—award amounts—Official Entry Blank. There's no obligation. Competition closes midnight, Dec. 31, 1943. DeVRY CORPORATION, Dept. 8 PM, 1111 Armitage Avenue, Chicago, 14, Illinois.

DeVRY

New York • CHICAGO • Hollywood

AN OUTSTANDING NAME IN THE CINEMATIC WORLD

**HERE'S IDEAL PROTECTION
AGAINST INDUSTRIAL
Skin Irritation**

**M.S.A
FEND-A**

**BARRIER PROTECTIVE
CREAMS and LOTIONS**

Does your job entail handling or working with materials that might irritate the skin? You can prevent unsightly, painful skin conditions due to irritation by using the type of FEND Industrial Protective Cream suitable for your particular need—easy to apply, easy to wash off, invisible, and *really effective!* Ask your supervisor about FEND!

MINE SAFETY APPLIANCES COMPANY
BRADDOCK, THOMAS AND MEADE STS., PITTSBURGH, PA.



THERE IS NO SUBSTITUTE
FOR EXPERIENCE



FIRST COUSIN TO A PURSUIT SHIP



The Sea-Horse outboard motor, being a little fellow, doesn't roar. It purrs. But its purr results from the same characteristics that distinguish airplane motors—sheer quality, high relation of power to pounds, and smooth, **DEPENDABLE** operation.

Fact is, Johnson used aluminum to revolutionize small motor design way back in the days when intrepid fliers were barnstorming in crates. Stainless steel, chrome, molybdenum and nickel alloys and other fine metals followed—until Sea-Horses were composed almost entirely of the materials *most urgently* needed in the Nation's present program of war plane construction.

Today's Sea-Horses are all for the armed services. Tomorrow's Sea-Horses, built out of twenty years' experience, will be revelations in performance. • Johnson Motors, Waukegan, Illinois.

DO YOUR DUTY — BUY WAR BONDS

JOHNSON SEA-HORSES

for ***DEPENDABILITY***

The Machine of 1000 Uses New DURO HAND GRINDER



THE ideal hand grinder for craftsman and model makers. The DURO Heavy Duty Grinder eliminates tedious hand filing, carving, buffing, polishing and scratch brushing. Does delicate, accurate work in fraction of time. Packs plenty of power and speed—24,000 R.P.M. Powered with fully universal G.E. motor. Of streamline design—only 6¾" in length. Has approved Underwriters' cord. Collet chuck with capacity up to ½". 110-V A.C. or D.C. current, 60 cycles or less. Has many special features including New Departure ball bearings, shock proof motor case, adequate cooling fan, push-button switch. Also available in lighter "Streamline" model at \$9.95 and in complete Heavy Duty Grinder Kit at \$22.95.

DURO TOOLS

MACHINE TOOL DIVISION

ALSO MAKERS OF DURO HAND TOOLS

only
\$15.95



Send for
**Complete
Circular**

giving full details, specifications and prices on DURO Hand Grinders—also for catalog of complete line of DURO Machine Tools.

Duro Metal Products Company
2652 N. Kilbuck Ave., Chicago, Ill.

Gentlemen: Send me complete circular on DURO Hand Grinders—also FREE copy of latest DURO Catalog.

Name.....

Address.....

City.....State.....

HANDKERCHIEF TEST PROVES VITAL ZONE

Spotless

NO MATTER HOW OFTEN YOU SMOKE IT

HESSON GUARD

MILANO \$1

IT'S CUSHION
SEALED

NO GOO CAN PASS
HESSON GUARD

STOP

GOO



SYN-FLO...

A NEW MAGIC

**LIQUID-PLASTIC
ENAMEL**

- ★ Finishes walls like **TILE**
- ★ Finishes woodwork like **PORCELAIN**

This is really it! Modern science has produced this new white **PLASTIC** coating you apply with a brush. It actually has the same chemical properties of genuine molded plastic products.

A BRUSH-ON PLASTIC

With an ordinary brush you flow this coating on your woodwork and it dries to a smooth porcelain finish—hard, water-proof, abrasion-resistant—stays brilliant white.

You won't have to wait until after the war for this new, scientific, plastic discovery. Limited quantities now available.

MONEY-BACK GUARANTEE

One gallon **SYN-FLO Liquid Plastic** will cover walls of average room. Send only \$5.95 for full Gallon **SYN-FLO** with Special Thinner, express prepaid. Will ship C.O.D. if desired.

LIMITED SUPPLY AVAILABLE
TO PUBLIC NOW. ORDER AT
ONCE! FREE ILLUSTRATED CIR-
CULAR ON REQUEST.

SUPERIOR PAINT and VARNISH WORKS
2256-2274 N. Elston Ave., Chicago 14



Build This Scale Model JEEP



Here's the model of the hour! An authentic 1" to 1' scale replica of the U.S. Army Jeep. There's nothing more fascinating to assemble; nothing you'll be more proud to display. No special tools necessary. Kit contains everything—Full size, step-by-step plan. Completely Finished wood parts. Detailed printed parts in Color. Five finished scale wheels. Glue, Paint, Etc. Get your Jeep Kit today. Send check or money order to ...

H. F. Auler Co., 165 N. Broadway, Milwaukee 2, Wis.

DIE-LESS DUPLICATING

Many small parts can be formed without dies, to duplicated accuracy of .001" with DI-ACRO Precision Machines—Benders, Brakes, Shears—saving Man Hours and Critical Materials. **Require priority of A-1-A or higher.** Write on business letterhead for catalog, or state if employed in War Production.

O'NEIL-IRWIN MFG. COMPANY
341 8th Avenue S., Minneapolis 15, Minn.



SHEAR

BENDER

BRAKE

Learn TOOL DESIGN

Qualify quickly as Machine or Tool Designer through sparetime home study. Many making \$100 to \$125 a week. Expanding industry calling for more machine and tool designers than available. Good pay jobs waiting. Rush name and kind of job wanted today for full free facts.

OHIO INSTITUTE OF TECHNOLOGY, Box 125, Greenville, Ohio

MEN! Maybe You Wouldn't Dream of
Dyeing Your Hair ... But Now

CHECK GRAY HAIR COLD WITH VITAMINS

**See Quick Results At Temples, Roots
and Parting or Money Back**

If your hair is gray, graying, streaked, faded or off-color, modern science offers new hope without dyeing. A lack of certain vitamins in your daily diet can cause hair to turn gray. Improve your diet, get extra supplies of these "anti-gray hair" vitamins by simply taking the original 2-way Panates Vitamin treatment. You too may be amazed and delighted to see the gray spread stopped, restoration of normal natural original color to the hair at roots, temples, parting, a great improvement in your hair beauty. You can now test Panates yourself on an iron clad guarantee that leaves no room for doubt. **PANATES** is different—it not only contains a powerful supply of "Anti-Gray Hair" Vitamins but "staff-of-life" Vitamin (E) Wheat Germ Oil as well. Panates is not a hair dye. You have nothing to fear ... no mess no fuss. You can test safe, healthful Panates whether you now dye your hair or not because Panates Vitamins work from within to check gray spread and literally feed natural color back into the hair roots.

Send For This Introductory Trial Offer Today

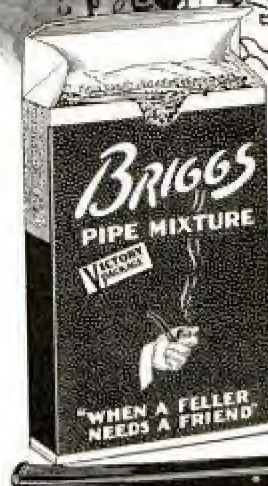
The 30-day trial of the regular \$4.79 (90-day) Panates double action Vitamins is only \$1.79 if you act at once! **SEND NO MONEY**, pay postman plus C. O. D. postage on arrival on guarantee of full satisfaction or money back. Send \$1.79 and we pay all postage. Or if you want more of the amazing Panates Anti-Gray Hair Vitamin Story, write for **FREE Valuable Booklet**, "Vitamins and Gray Hair." No cost, no obligation. Whatever you send for, put your letter or postcard in the mail today while Special Offer is available. Who knows, perhaps the 2 vitamins in Panates may be the wonderful easy-way answer to your hair color worries! Not in stores. Write

PANATE CO., Dept. C-240, 310 So. Michigan, Chicago 4

POPULAR MECHANICS



The short cut to a long education in pipe-tobacco is—a package of Briggs right now. You'll see right off that Briggs is the grand prize of pipedom, from the first fragrant, tantalizing sniff to the lingering delight of its luxurious, caressing taste. Because Briggs is cask-mellowed for years—longer than many costly blends—and *you* harvest all its full-ripe richness! So go to it, man—try a package of Briggs *today*.



BRIGGS

The Smoke with
a Smile

PRODUCT OF P. LORILLARD COMPANY.



KRW ARBOR PRESSES BENCH TYPE AND HYDRAULIC

NEEDED IN EVERY SHOP—SAVE TIME AND MONEY—DO BETTER WORK, QUICKER.

No shop is complete without a small arbor press. Pressing and squeezing operations can be done better and faster on a KRW Arbor Press. Stop using vise and sledge hammer methods—they generally deliver spoiled work in the end. KRW Factory-To-You Prices give you greater value for your money. Order today.

KRW Bench Type Arbor Presses, 3 sizes

No. 37-P 1/2 Ton, \$13.25*
No. 37-O 1 Ton, \$23.00*
No. 37-N 3 Ton, \$33.00*
*Prices F.O.B. Arcade, N. Y.
Slightly higher west of Rockies.
Stand illustrated extra.



KRW Hydraulic Presses are built in 25, 50 and 75 ton sizes. Prices start at \$198.00*



K. R. WILSON, 17 Lock St., BUFFALO, N. Y.
Builders of Shop Equipment for Ford Dealers Since 1916

MEDICO FILTERED SMOKING

SENSATIONAL PIPE FILTER ALSO IN CIGARETTE AND CIGAR HOLDERS

No wonder millions have switched to this amazing and revolutionary filter invention—the greatest improvement ever known in pipes, cigarette and cigar holders.

Inside of cellophane exterior are 66 mesh screen "baffles" which whirlcool smoke—retain flakes and slugs, minimize juices, raw mouth, and tongue-bite. Improves taste and aroma of your favorite smoke.

This filter is the "heart" of Medico Filtered Smoking. When discolored, put a fresh one in your pipe or holder. Costs only ONECENT. Do not miss the benefits of mild, sanitary, Filtered Smoking.

Something wonderful goes on inside

GENUINE
FILTERS
FOR MEDICO
PACKED
ONLY IN
THIS RED AND
BLACK BOX



X-RAY VIEW OF FILTER

\$1.00

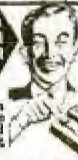


AUTO ENGINE SPEED CONTROL GOVERNORS

Give constant speed to any make of auto or truck engine, regardless of load changes, when used for power. Fully guaranteed. Simple instructions. Oil ring bearing \$13.00. Ball bearing \$19.50. Prepaid. Montreal branch, 7546 Wiseman St. Latin Amer. East Asiatic Co. Free circulars. CANDEE, 2641-K S. Hill, Los Angeles-7

Now you can own these
"Western Union" Electric

Be Your Own
TELEGRAPH
OPERATOR



IT BUZZES!
As used in Wireless.
IT FLASHES!
As used in Night
Signaling.
IT CLICKS!
As used in
Telegraphic.

Each set is a
complete
sending and
receiving unit
in itself.

You get TWO receiving and sending outfits, each in a compact metal case containing Sending Key, Buzzer, Flasher Bulb, Clicker and battery compartment, completely wired for sending and receiving—both outfits at the one low price of \$3.95. You also get complete instructions and Operator's Manual including "Morse Code Used by Western Union", "Aids in Learning International Code", and "Q Signal Code". Also Western Union telegraph blanks. An unusual chance to prepare for the future! Learn the same Morse Code used by the Army, Navy and Marines. Use your sets for home learning or for sending messages between rooms or buildings. Immediate delivery. Order today!

RADIO WAREHOUSE MARKET, 362 Wooster Ave., Akron, Ohio

Tear out this ad, write name and address in margin, mail \$3.95 and we will send outfits at once POST PAID. Or order C. O. D. pay postman for outfits plus postage

180

NEW Things in CLAMPS



GRAND QUICK LOCKET

The Magic Clamp
with Trigger Release

Unequaled for light fast work. Setting the pace in war production. Finger operated, its long leverage, cam-action converts a press of the thumb into a firm, tight grip. Spring tension and trigger teeth hold firm ratchet grip on screw which releases instantly with trigger pressure by thumb or finger so that screw may be slipped to any desired position with a single motion—or, may be immediately reclamped to other work of the same thickness without further screw adjustment. Swinging, locking lever, gib seat makes it absolutely "non-creeping" and assures firm grip on any parallel, slanting or rounded surface. Free acting swivel with fibre face that prevents marring or scarring. Made also with fibre jaws for aluminum and other softer metals. Ask about the complete GRAND Line of Speed Clamps.

Write for Circular

GRAND SPECIALTIES COMPANY

Est. 1921

Grand Avenue at Troy, CHICAGO 22, U. S. A.

GRAY HAIR VITAMIN NOW \$1.95

No dyes—No drugs—Hair grew out in Natural Color in almost nine out of ten test cases just taking one tablet Calcium Pantothenate Vitamin each day.

PAY
NO
MORE

Why pay \$3.50 to \$5.00 for the famous "Gray Hair Vitamin"?

SEND NO MONEY. Just send name and address. We will ship 100 10-mg. tablets (100 days' supply) genuine standard quality Calcium Pantothenate Vitamin C.O.D. for \$1.95 plus few cents postage. Guaranteed same quality as used in National Tests or money back.

LILEE PROD CO., 2017 S. Michigan Ave., Dept. 911, Chicago, Ill.

LEPAGE'S GLUE

LEPAGE'S MODEL AEROPLANE GLUE
LEPAGE'S LIQUID SOLDER

BURN YOUR NAME ON TOOLS

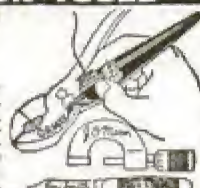
WITH THE ARKOGRAF

PROTECT YOUR TOOLS FROM THEFT

Write with electricity any name or design on the barrel and finish tools and instruments or any metal, like writing on paper with pen or pencil. Thousands used by mechanics, carpenters, hardware shops.

Complete Outfit \$3.50—Prepaid Anywhere

Interesting illustrated circular from. Write today. ARKOGRAF PEN CO., 3927 S.E. Stark St., Portland, Ore.



YOU GET
2 SETS
LIKE THIS

SENDING & RECEIVING SETS

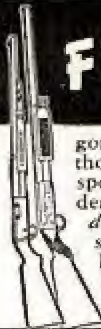
3 SETS with
BATTERIES
in Case
\$3.95
POST
PAID



MONEY
BACK
GUARANTEE

POPULAR MECHANICS

FREE 1943-44 BARGAIN GUN CATALOG



gorgeously illustrated . . . featuring thousands of guns and "hard-to-get" sports items from America's largest dealer; send 25¢ (refunded with first order). We also buy and swap Guns, Ammunition, Reels, Rods, Outboards.
KLEIN'S SPORTING GOODS
508H So. Halsted, Chicago 7



Wanted! New Products!

Long-established and well-known company with modern plant for production of precision devices wants new products for post-war manufacture. Particularly interested in small and medium-sized motor-operated tools or appliances. Ideas need not necessarily be completely developed. Send only description of product, indicating purpose, market and advantages for complete, prompt, and confidential consideration. If your idea has possibilities, and will fit into our plans, further arrangements can then be made. Address Research Department,

The Dumore Company, Racine, Wisconsin

RADIO PARTS

Still Available

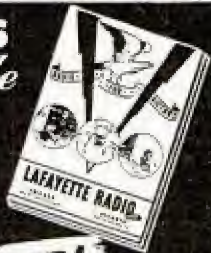
Lafayette Radio Corporation can supply all standard radio replacement parts plus a wide variety of useful parts and equipment for non-critical consumer applications.

Write Dept. IIP3 today for the free 130-page catalog of Radio and Electronic Parts and Equipment.

FREE!

LAFAYETTE RADIO CORP.

901 W. Jackson Blvd. . . Chicago 7, Illinois
265 Peachtree St. . . . Atlanta 3, Georgia



BRUSH PLATING OUTFITS

for autoparts, reflectors, faucets, bicycles.
No tanks necessary. Free particulars.

GUNMETAL CO., AVE. M, DECATUR, ILLINOIS

Here's a
Good War-Time Business
With a big Peace-Time Future

SAW-FILING

Machine saw filing with the Foley Automatic Bar Filer makes old saws cut like new again. Does the work so much faster and better you can make up to \$2 or \$3 an hour. No eye-strain. This one machine files all hand saws, chain saws and circular saws. No special priority required, delivery guaranteed. FREE PLAN shows how to start, no experience necessary. Send coupon today.



FOLEY MFG. CO., 1116-3 Foley Bldg., Minneapolis 13, Minn.
Please send FREE PLAN on saw filing business.

Name
Address

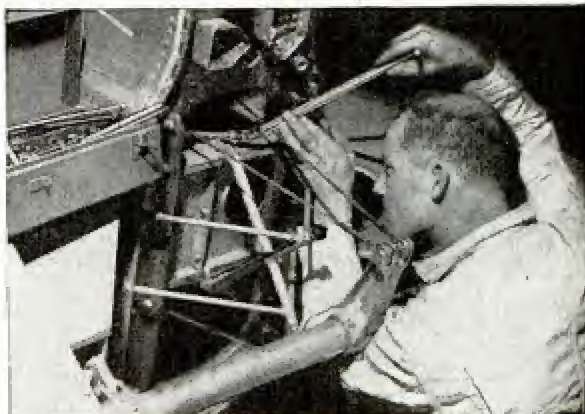
NOVEMBER, 1943



"Much credit for the successful maintenance work on both our commercial and military planes is due to the dependability of Snap-on tools, with which the majority of our mechanics work."

Thomas D. Brooks

Superintendent of Maintenance
CHICAGO AND SOUTHERN AIR LINES



ANOTHER GREAT AIR LINE

Endorses Snap-on Tools!

With its far-flung commercial routes supplying swift and dependable transport over the strategic heart of America . . . with giant hangers busily engaged in important modification work for the Army Air Forces . . . Chicago and Southern Air Lines know the importance of good tools in every phase of aviation. Says Thomas D. Brooks, Supt. of Maintenance:

"Chicago and Southern mechanics assigned to both commercial airline and military transport, as well as modification work, have found Snap-on tools adaptable to work where there is very little room available, where the fitting of a tool is of the utmost importance to a dependable job, and where the strength of the tool saves time and in many cases prevents injuries."

Snap-on tools are endorsed by leading air lines, foremost plane manufacturers and engine builders. Their accuracy, flexibility and ease of application meet today's urgent need for speed, and more speed. In victory-gear industry throughout America you'll find them in the hands of men who know tools . . . the choice of better mechanics!

SNAP-ON TOOLS CORPORATION, Kenosha, Wis.



Always write your name and full address clearly when answering advertisements.

Install **SCIENTIFIC SEATING** — Relieve Fatigue Improve Output, in Quality — in Quantity



To adjust, simply lift seat. Each chair and stool instantly convertible for different working postures or persons.

Enjoy perfect posture for efficient freedom of movement. Conserve physical energy. Sustain mental alertness! Banish work-weary indifference due to tired backs, muscle-bound legs. Cut down rejects. Let scientific seating pay you a profit . . . often returns its investment every 24 hours. Make your own tests. Try a "Keweenaw" and compare both quantity and quality of worker's output.

Keweenaw CHAIRS and STOOLS

INSTANTLY ADJUSTABLE for HEIGHT or BACK REST

**FOR OFFICE
FACTORY
SCHOOLS AND
PRIVATE
WORKSHOPS**

Available without priority because made of wood. Scientifically constructed by seating specialists. Ton-Tested to insure rugged use. The ideal seating equipment where persons of different size must use the same chair, as when shifts change. Each worker adjusts chair or stool easily and instantly to personal fit — no tools needed. Built in a variety of adjustable heights. Stools with and without back-rest or foot-rest. Write at once for illustrated folder and Special Trial price offer.

KEWAUNEE MFG. CO. • Evanston, Ill.

SPECIAL for Draftsmen, Etc.

Comfortable Foot-Rest for high working postures where feet do not reach the floor. Write for details.

Make **BIG MONEY AT HOME!** **NEW Invention Electroplates by BRUSH**



Now Plates CHROMIUM!
ALSO GOLD, SILVER, NICKEL, COPPER, ETC.
War Increases Demand—You Profit!

New, patented invention makes possible big earnings **AT HOME**. Replate auto-parts—worn articles in homes, stores, hotels, restaurants, etc., with durable, sparkling, new coat of metal—with stroke of brush. Easy, simple, quick. Genuine Gold, Silver, Nickel, Cadmium, etc. Everything furnished. Outfit complete, ready for use. No shop required. Clear from \$2 to \$5 an hour in lifetime business. Small investment starts you in business. Steady repeat. Machine can pay for itself in week. Send **TODAY for FREE SAMPLE** and illustrated **BOOKLET** how you can have a life income from a business of **YOUR OWN** built upon satisfied customers. Act at once!

WARNER ELECTRIC COMPANY

663 N. Wells St., Chicago, Ill., Dept. 307

FREE BOOK & SAMPLE

WARNER ELECTRIC CO., 663 N. Wells St., Chicago, Ill., Dept. 307
Gentlemen: Send me Free Sample and Illustrated Booklet.

Name _____

Address _____

City _____

State _____



only
10c

Wood workers: Here it is! Harold

Hunt's big revised No. 14 wood catalog! Latest **UP-TO-DATE** IDEAS for experts and amateurs; **SPECIAL** BARGAINS in rare woods, veneers, and ALL kinds of supplies. 124 pages—12 of rare woods in color. Get posted. Send only 10c to **CRAFTSMAN WOOD SERVICE CO.** 2729 S. Mary St., Dept. A-39, Chicago, Ill.

QUICK REPAIRS!

Loose drawer pulls can be quickly, easily reset with P.W. Handles like putty; hardens into wood. At Paint, Hardware and 10¢ Stores.



PLASTIC WOOD

"HOW TO WORK WITH TOOLS AND WOOD" A popular book on woodworking, packed with illustrated instructions for beginners, and with useful data for experienced woodworkers. Every home workshop should have a copy. A Big Value at \$1.00

STANLEY TOOLS Division of The Stanley Works, PM-1311 Elm St., New Britain, Conn.

SHAW and "Peppy-Pal" GARDEN TRACTORS

• 1 to 9 H.P. Circulars on request. War limits production . . . We supply repairs for all SHAW tractors sold in our 40 years in business. Write for your needs.

BUILD YOUR OWN RIDING TRACTOR—"WAR HORSE"

by using old auto parts, powered by 3 H. P. Briggs and Stratton or other engine, larger or smaller, as shown here; or walking type Garden Tractor 1/2 to 3 H.P.; or convert truck or auto into Farm Tractor. Plans for building any one of above postpaid for \$1.00 (state which wanted) or all 3 for \$2.00. Money Back Guarantee! **SHAW MFG. CO., 4511 Front St., Galesburg, Kansas** 6686 North 4th Street, Columbus, Ohio



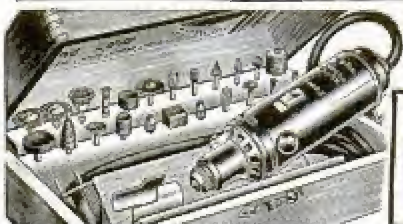
DO YOU

WANT a permanent business profession of your own? Then **BECOME A FOOT CORRECTIONIST**. Earnings in this greatly needed profession run as high as \$50-\$100 weekly after a few weeks home training—not medical or chiropody—no further capital needed, no goods to buy. 47th year. Write for free booklet.

Stephenson System of Foot Correction

28 Back Bay,

Boston, Mass.



WAR WORKERS-WIN "PRODUCTION AWARDS"

Dremel Moto-Tools are used on hundreds of jobs, in thousands of war plants, because they are such great time and labor savers. Sharpening tools . . . cleaning dies, castings, cores and welding points . . . grinding, polishing, burning and finishing . . . these are but a few of Moto-Tool's many capabilities. Only Moto-Tool has all these features—27,000 r.p.m. (assures better work and lengthens life of cutters); shockproof (buckles) case; oil-less (oil-sealed) bearings; fan-cooled motor (can't overheat). Order Moto-Tools and accessories at your dealer, or direct on 10-day trial. Money-back guarantee. If you need a Moto-Tool in your work, ask your employer for a priority number. **Color FREE.**

Kit No. 1 with 23 high grade accessories and Model 1 Moto-Tool in hard wood case \$17.50
Kit No. 2, same as above with Motor Model Moto-Tool \$23.50

DREMEL MFG. CO., Dept. T-113-L, Racine, Wis.

MOTO-TOOLS

TO SAVE TIME—CUT COSTS AND SPEED PRODUCTION

POPULAR MECHANICS



NOW a DYNAMIC HEAVY DUTY INDUSTRIAL WELDER

for Only \$23.50

COMPLETE

Saves VALUABLE TIME and MONEY!

AMAZINGLY SIMPLE & EASY TO OPERATE
This portable Dynamic Welder—easily carried right to the job—plugs into any convenient, properly wired 110 volt light circuit—works on Iron, Steel, Brass, Bronze and other metals—has electric metallic and carbon arc welding heat stages—does work you would think only possible with a larger, more expensive machine.

DESIGNED TO DO HIGH GRADE WELDING INEXPENSIVELY
Maintenance Men; Farmers; Mechanics; Machine Shops; Foundries; Auto, General Repair and Job Welding Shops; using the Dynamic find it so indispensable and useful that they cannot afford to be without it. If inexperienced, you can easily learn to do a variety of high grade welding jobs by following the practical, simplified operating and welding instructions furnished.

DYNAMIC WELDER CO., 2226-G Silverton Road, Chicago 16, Ill.

Once you see a Dynamic in operation you won't be without it. Its simplicity will amaze you. In a year the Dynamic only costs you about 6c a day.

Comes complete with helmet, rods, cables, electrode holder and operating instructions, etc.

Write today for free priority assistance and particulars on how to qualify for one of these amazingly low-priced welders. Act now while they are still available. Get details on our 10-day trial offer.

HOW TO GET AND KEEP GOOD EYESIGHT



SAVE YOUR EYES



Do you want perfect 20/20 vision? Great numbers of men, women and children have improved and strengthened their eyes by using the famous Ross-Rehner Method, a tested and proven system of home eye exercises for correcting nearsightedness, farsightedness, color blindness and astigmatism.

Better Eyesight — Without Glasses

Now you can get the entire system, as recommended by Drew Pearson, profusely illustrated, including a complete Eye Testing Kit, with charts to show weekly improvement. If your book store does not have it, send one dollar. Delivered postpaid, subject to return in 5 days if you are not satisfied. Order today.

**HALL PUBLISHING CO.
BLOOMFIELD HILLS 2, MICHIGAN**

FIX YOUR OWN FURNACE!



**Easy modern way
saves time—dollars**

Now you can save your cracked or burned-out firepot. You don't need to buy expensive new castings—don't even have to take down your furnace. Simply line the old firepot with

FIRELINE

Fireline is installed as a complete lining entirely around the firepot. It seals all cracks and holes—makes the firepot gas tight—prevents leakage of dangerous gases, soot, and odors into the house.

Fireline is highest quality refractory material as used in large power plants. The fire bakes it into a durable lining that withstands 3000 deg. F. Easily installed; you can do it yourself in a couple of hours. Fire can be started immediately.

More Heat from Less Fuel!

Unlike unlined castings, Fireline gives a hot, bright fire across entire fuel bed. It produces better combustion; eliminates unburned fuel in ash; gives more heating comfort while cutting fuel cost. Used in good firepots to save fuel and preserve castings.

Write today for circular. Your hardware store or furnace dealer has Fireline, or can get it from his jobber.

**FIRELINE STOVE & FURNACE LINING CO.
1889 Kingsbury St. Chicago 14, Ill.**

BUILD A WELDER

For Light or Heavy Work. 30-200 amperes. Complete **PLANS \$5c.** Send today and we'll include FREE our Big NEW Catalog.

**LEJAY MANUFACTURING CO.
1347 LeJay Bldg., Minneapolis, Minn.**

FROM OLD GENERATOR




**WORLD'S LOWEST PRICED
ADDING MACHINE**

IDEAL FOR BUSINESS — GUARANTEED ACCURATE. Not a toy. Operates with only a finger flick. Adds, subtracts, multiplies, divides. Counts up to ten million. Pays for itself over and over. **Ideal Gift—for Business, Income Tax and School use. MONEY BACK GUARANTEE.** Send name and address. Pay postman only \$2.00 plus postage. (Send full cash if outside U. S.) Money back in 10 days if not delighted. **AGENTS WRITE.**

**CALCULATOR MACHINE COMPANY (Mrs.)
DEPT. 147, P. O. BOX 1118 CHICAGO, ILLINOIS**

New "TRIG" 10" Slide Rule



SPECIAL OFFERS


28-page instruction book and slide rule carrying case included in all offers.

- No. 1**—New "TRIG" 10" Slide Rule (with S, L, and T scales) Gun-metal Finish Indexing, \$1.00 postpaid.
- No. 2**—New "TRIG" 10" Slide Rule (A, B, C, D, CI and K Scales only) 50c postpaid.
- No. 3**—Subtracting up to 999,999; 6-inch Transparent Protractor and Graph Rule graduated in centimeters and inches. \$1.50 postpaid.
- No. 4**—Standard 10" Slide Rule, Pocket Calculator, Transparent Protractor and Graph Rule, \$1.00 postpaid.

FOREIGN—add 10c to each price.

TO INSURE GETTING YOURS PROMPTLY—Mail Coupon NOW

SLT Scales Added

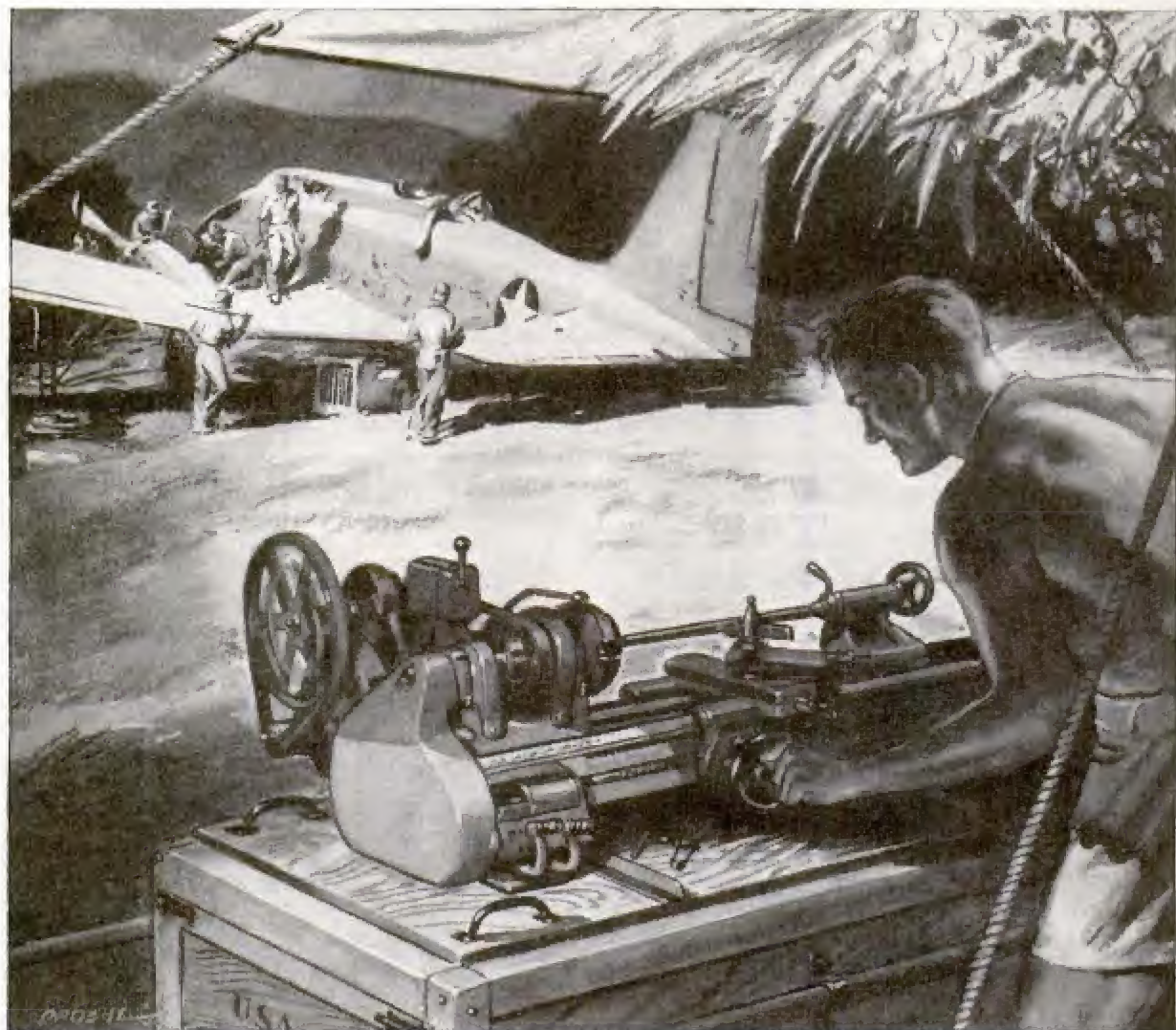


\$1

Standard 10" slide rule with A, B, C, D, LOG, TANGENT) on reversible slide for problems in trigonometry. Enables you to make difficult calculations instantly without paper or pencil—in multiplication, division, proportion, squares and cubes, square and cube roots, logarithms, and trigonometrical problems. Satisfaction guaranteed or money refunded. (See Special Offers)

HEWIG CO., Box F-143, Grand Central Annex, New York, N. Y.
Enclosed is remittance covering Special Offer checked below:

SPECIAL OFFER ☐ No. 1 ☐ No. 2 ☐ No. 3 ☐ No. 4
(Please print)
Name: _____
Address: _____



The Flying Lathes of the Air Corps

One of the toughest jobs of the Air Corps Technical Service is to get disabled planes back into the air when they have been forced down in remote locations. No matter where the plane is grounded, skilled technicians must get there quickly with all the tools and equipment required to make emergency repairs.

Precision machine operations are sometimes required—so the Air Corps is prepared to fly a Precision Lathe wherever a plane can land. Packed in special, lightweight cases and fitted with accessories for doing a variety of work that would surprise you, these flying lathes are an important part of the Air Corps' emergency service equipment.

We are proud that South Bend Lathes have been selected for this important service—one of the many vital assignments that are keeping South Bend Lathes busy for the duration.

SOUTH BEND LATHE WORKS

SOUTH BEND, INDIANA

LATHE BUILDERS FOR 37 YEARS

PRINTED BY POPULAR MECHANICS COMPANY, CHICAGO, ILL., U. S. A.

*Buy
War Bonds*





GREASE for GEARS but NOT for SHAVING

Grease is great for machines, but men hate to put it on their faces. That is why so many men are switching from ordinary brushless to the new Mennen Brushless Shave — it's a cream, not a grease! Get it in either jar or tube.





by the Fighting Engineers

When there are tanks to be stopped — watch the Engineers! "Tank block — rush it!" is the order... and the photograph at the right (an actual training test) shows the result.

Stopping tanks is only a *part* of the job of the fighting U. S. Engineers. And, like men in all the other services, you're apt to find that when an Engineer lights up a cigarette — it's a Camel.



They've Got What it Takes!



CAMELS SURE
STAND THE TEST OF
STEADY SMOKING!
THAT SWELL **FLAVOR**
ALWAYS HOLDS UP...
AND THEY'RE
EXTRA
MILD!



First IN THE SERVICE

The favorite cigarette with men in the Army, the Navy, the Marines, and the Coast Guard is Camel. (Based on actual sales records.)

The "T-Zone"

where cigarettes are judged

How long since you've smoked a Camel? Give them a try today. Compare them critically... for taste... for your throat... for your "T-ZONE." We believe you will like the extra flavor that Camel's costlier tobaccos give. We believe your throat will confirm the findings of other Camel smokers. So try Camels in your "T-ZONE."



Camels

R. J. Reynolds Tobacco Company, Winston-Salem, N. C.